

# **Regional Market Analysis for Fresh-cut Apple Slices**

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# **New England Apple Slice Product Feasibility Study**

## ***Executive Summary***

There is a critical need to develop alternative markets for New England apples that will increase grower profitability. The current apple market is characterized by declining returns in the wholesale market due to consolidation in the food industry, which has reduced market options for New England producers, aggravated by competition from western and global apple sources. As the wholesale price drops, growers find it increasingly impossible to make ends meet forcing more and more orchards out of business.

A New England apple slice product offers the regions' apple industry the opportunity to:

1. Expand per capita consumption of New England apples, similar to that experienced in the carrot industry from the introduction of 'baby' carrots.
2. Stabilize and pressure up the price of all apples due to a new demand source.
3. Create an alternative market for apples now sold in poly bags.
4. Create a market and increase grower price as much as \$5 - \$7 per case (depending on market conditions) for undervalued 2 3/4 - 2 7/8 size apples (not big enough for a premium priced 'count' apples; larger than a 3 lb. bag apple) and for apples discounted for color.
5. Earn \$1 to 2 per case more for apples sold for fresh slices due to sticker and packaging savings.
6. Create a new market for Acey Mac, Cortland (Red Cort and Standard), Spartan, Empire, Gala, Paulared and Ginger Gold apples.
7. Forward contract to regional processors to ensure supply needs.

The New England Apple Slice Feasibility study learned that

1. McDonald's is now introducing the product to thousands of New England consumers each day, speeding knowledge, interest and acceptance of sliced apples. On a national level, McDonald's uses about 64 million pounds of apples a year, about 1.5% of the fresh market supply, to make Apple Dippers. The Waldorf type apple walnut salad adds another 40 million lbs. Besides boosting total apple consumption, McDonald's impact could replicate and exceed its effect on the grape tomato industry, which saw sales increase by 25% after the chain began using the product in its premium salads.

2. The fresh cut produce industry considers apple slices to have the potential to be the next baby-cut carrot success story which at twice the retail cost per pound has seen carrot consumption double, and now far outsell traditional poly bagged carrots.
3. Consumers say they would buy sliced apples primarily for snacking; 65% would purchase fresh slices over whole; 55% would buy both. (Michigan study) Consumer response to New England slices at the Big E was extremely positive; school introductions in Vermont, New Hampshire and Rhode Island have seen enthusiastic response from kids and Foodservice directors.
4. While the technology for maintaining the shelf life of fresh apple slices is available, it is a much more complex undertaking than simply applying a special coating to a fresh apple slice. The manufacturing process is extremely challenging and it requires a substantial capital investment. The cost of building a 7, 500 square foot facility capable of producing 500 to 1000 lbs. of slices per hour is estimated in excess of \$1.5 million. Entry as a processor is most feasible for an existing fresh – cut business that could retrofit to add fresh slice apples to its product line.
5. Because of investment risk and the need for food processing expertise and a multi product line, this is not a business that one orchard or a group of growers is likely to enter until the market for New England apples slices is firmly and extensively established.
6. The market for sliced apples in New England is undeveloped. **The opportunity for New England growers is to work with an existing sliced apple processor to develop the sliced apple market in the region with a branded New England product.** Growers could supply apples to the processor or they could create a marketing venture to sell slices made with their apples.
7. The school market, breakfast, lunch and snack programs, uses 2 oz. sliced apple packs as a fruit equivalent, as an à la carte item and as a DoD product.
8. The retail market is receptive to 2 oz. multi-packs and to larger 6 to 10 oz grab and go packs.
9. Foodservice channels, especially those in hospital, health and fitness organizations, would consider larger 3 lb. packs for salad bars and small packs for cafeteria lines.
10. Vending companies prefer 2 oz. packs.
11. All markets need significant promotional support. All are price sensitive. The product needs to prove itself in all channels. The good news for apple growers in New England is that in a region where local is strongly preferred, there is significant opportunity for a branded sliced apple product.

12. New England growers have a \$ 4 - 5 per case freight price advantage over whole apples shipped from the west to slice processors and over sliced apple products shipped to New England markets.
13. New England growers also have a freshness advantage over western slices, an important attribute for a perishable product with a 2-week shelf life. All markets prefer frequent deliveries to assure product quality.

### **Business concept**

For maximum market and industry impact, the opportunity for the New England apple industry is to co-pack apple slices at an existing processing facility and concentrate resources on innovative product development and marketing. While the marketing mix will include sales to schools, retailers and foodservice accounts, just slicing apples and packaging the slices in a poly bag for sale to the same channels as competitors, distinguished only with a New England label will not be sufficient for success. Ultimately a New England apple slice venture will need to take apple slices to another level, to create a product line with a new position in the market. For example a "Sliced Apples and....Cheese (cheddar, smoked or pepper, etc.)" and/or an "Apples and....Yogurt (paired with different varieties: maple, vanilla, lemon, etc.)" product line marketed in the dairy case.

The next step is to develop a formal business plan for the proposed venture.

# **A Regional Market Analysis for Fresh-cut Apple Slices**

## **Lynda Brushett, Ph. D. and Stephen Lacasse for the**

### **Cooperative Development Institute**

#### **January 30, 2006**

### ***Final Report***

**Study Purpose:** Provide growers, grower cooperatives, apple marketing organizations and other interested parties with the information needed to 1) determine the feasibility of procuring, processing, distributing and marketing apple slices in New England, 2) develop the marketing basis for a consumer test of the product; and 3) support operational business planning.

Product research indicates that:

- Apple slices have been in the market place since the late 90's; national distribution began to take off in 2002.
- McDonalds is now introducing the product to thousands of consumers each day.
- The fresh cut produce industry considers apple slices to have the potential to be the next baby carrot success story.
- The technology for maintaining the shelf life of fresh apple slices is available.
- The manufacturing process is extremely challenging, requiring substantial investment.
- There are many, including some very large companies producing sliced apples.
- Most are packing slices in poly bags and clam shell containers
- Marketing targets retail produce cases, school lunch and snack programs, and restaurant Foodservice salad menus.

For maximum market and industry impact, the opportunity for the New England apple industry will be to co-pack apple slices and concentrate on innovative product development and marketing. Simply slicing the product and packaging in a poly bag for sale to the same channels as competitors distinguished only with a New England label will not be sufficient for success.

New England needs to take apple slices to another level. For example, rather than create a product marketed through the produce department, an entrepreneurial approach would attain a position in dairy case with packaged product line of NE sliced apples paired with NE cheese (cheddar, smoked or pepper, etc.) and/or NE apples paired with NE yogurt (maple, vanilla, etc.), would use different (not poly bag) packaging, and would strategically focus marketing on target consumers.

## 1. Product Development

New product development is challenging work. Eight of ten new products fail. To be one of the two success stories, a new product must meet the challenges of Cost—investment in product testing, facilities, operations, marketing, etc; Competition—similar products in and entering the market; Market Fragmentation—finding a large enough niche quickly and attracting buyers in a crowded marketplace and Public Concerns and Governmental Regulation—food safety, environment and other issues. (Rowles *et. al.* 2001 p. 21)

This insight is from an apple product innovation workshop held in June 2000 at the New Products Showcase and Learning Center in Ithaca, NY. Participants were introduced to factors, which lend greater opportunity for success to new product development processes (p. 22):

- “ Strike a chord of familiarity. The core idea of the product should resonate with consumers.
- “ Keep it simple. Don’t confuse the consumer with multiple ideas.
- “ Know your market. Research the relevant consumer trends, product histories, patents, and regulations.
- “ Make sure the product fits your strategy and image. Don’t create a product just because you can.
- “ Study other product categories and markets. Most new product ideas come from other product categories.
- “ Fill current consumer needs.
- “ Learn from the past. Know the reasons for the failure of other products.

With these factors in mind, the single most important reason for product failure is lack of innovation. “Products that do not in some way provide a new benefit to the consumer are likely to fail.” (p. 22) What constitutes innovation? A new product that meets at least one of these criteria (p. 23):

- “ Provides a consumer benefit with new packaging
- “ Offers additional value with a new formulation
- “ Positions a product to new users or usage
- “ Introduces a new technology
- “ Opens up a new market for a product
- “ Uses a unique merchandising strategy

In a nutshell, “ a new product must motivate a consumer to take the risk of buying.” (p. 23). Motivators drive behavior and the four key motivators for consumers today are (p. 24):

Convenience: Consumers’ need for more time drives the purchase of on-the-go foods, meal solutions, and functional packaging.

Wellness: Fears about aging, declining health, and medical costs drive consumers to prevent and self-treat health problems with food and beverage products that offer health benefits.

Food quality and safety: Consumers are drawn to products that offer quality assurance and reliable food safety.

Gratification: Disposable income levels have been rising in the current strong economy, and consumers are seeking indulgence for themselves and their kids. They are drawn to buy gratifying products that taste good and offer the feeling, “I’m worth it.”

Given the number and size of companies in the market and the impact of Mc Donald’s Apple Dippers, apple slices *per se* are no longer ‘new’. Our challenge is to create an innovation in an apple slice product that will motivate intermediary customers (retailers, Foodservice etc.) and end consumers to buy it once and buy it often. We begin our strategic thinking with whole apples: How do apple characteristics relate to the motivators? Then we need to consider apple slices: How can we appeal to the motivators with packaging (e.g. film wrapped rather than poly bags? Other product combinations (e.g. dairy products such as cheeses and yogurts)? Flavor infusions (e.g. cinnamon, maple)? Different positioning in the grocery store (e.g. the dairy case rather than produce)? New customer targets (e.g. natural food consumers, active adults)? Different channels (e.g. refrigerated vending, health clubs)?

As we think about what would constitute a truly new, innovative and successful apple slice product, this report pulls together background information on raw product needs, production issues and market competition.

## **a. Raw Product Criteria**

### **1. Variety**

Apples for fresh slices have to meet both processing and consumer needs; varieties need to be available year round. On the processing side the challenges are 1) shelf life: prevention of browning and softening and preservation of flavor and texture; and 2) yield: maximizing usable slice count; minimizing waste. Preventing deterioration in the color, appearance and/or sensory quality of slices due to physiology or microbial growth is a serious challenge.

On the consumer side the slices must appear freshly cut, have no unusual smell or flavor, deliver an expected sweet or tart apple taste and be crisp and juicy. Packaging and presentation are key components of a consumer’s decision to buy the product.

To make acceptable slices with the best yield possible, the apples have to be firm and round so that they are easily sanitized and cut. Fresh cut companies are using Empire, Braeburn, Gala, Fuji, Cameo, Crispin, Jonathan, Pink Lady, and Granny Smith varieties. The most frequently used varieties are Gala, Pink Lady, Granny Smith and Empire. Processors indicate these varieties have longer shelf life and require less anti-browning material (especially in the case of Granny Smith). One of the processors in our market indicated that retailers here were driving the varieties toward west coast Gala and Granny



Smith because these apples are perceived to have better color and firmness than eastern apples and are available year round.

In their feasibility study McDougal Orchard in Springvale Maine experimented with Ginger Gold, McIntosh and Cortland and found Cortland best met their firmness and sweetness test. The softness of a McIntosh made it a poor choice for their operation as the variety have thin skin, bruises easily and browns quickly after cutting.

Other New England varieties with good fresh slice characteristics include AceyMac and Paulared.

Research indicates browning and softening problems with western Red Delicious apples (Toivonen et. al. 2001) would apply here as well.

As part of the study we shipped cases of Empire, Cortland (Red Cort and Standard), McIntosh and Rome for cutting and shelf life testing by an apple slice processor with a proprietary long lasting shelf life anti-oxidant and packaging system. Overall Red Cort performed the best, with good flavor, color, appearance and texture during 44 days of testing, followed closely by Empire. McIntosh began fermenting within 25 days and was determined the least acceptable. Romes maintained acceptable flavor and texture after 37 days, but the bleeding of red color from the skin into the flesh created an undesirable appearance. Standard Cortland appearance and was acceptable throughout testing, but eventually developed a mushy texture.

## **2. Grade, quality, size**

There are no standardized industry specifications for a fresh sliced apple. The closest grade would be US Fancy or better. Quality requirements are much greater than for apples typically sliced for baking. Most processors prefer to use the highest quality dessert apples available. Several noted that a sample of apples are sliced and peeled before being accepted from the seller. Apples must be firm and sound, without bruises. For slices with skin intact, apples must be free of exterior blemishes (scab, limb rub, russet, frost rings, etc) and internal defects, such as browning.

Equipment needs determine size. Apples can range from 2 5/8 to 3 inches with 2 3/4 to 3 preferred (140's, 120's, 113's, 100's) and with a 15 lb. measurement of firmness. Apples less than 3 inches in diameter are preferred because they are less expensive.

## **3. Special requirements (such as PLU stickers, wax, smart fresh)**

Apples should be delivered without stickers. Smart Fresh which is applied as a gas in the beginning of storage slows the softening process of aging, improving the apple's shelf life when it comes out of storage, enabling it to stay crisper longer. For some varieties this may become a requirement for use as fresh slices.

Dr. Peter Toivonen an apple slice researcher from the University of British Columbia told us "the use of waxed apples for slicing is not advisable for cosmetic reasons. We have

worked with both waxed and unwaxed apples and our general observation is that waxed apples will start to “peel” in blotches once the fruit is cut, washed, treated and bagged. The effect is much like blistered and peeling paint on wood – I don’t find that to be very appealing. The other issue with waxed fruit is that they are also exposed to hot air after the dip tank emulsion of wax. This heating process can impair quality, if the fruit are not cooled immediately afterward. Finally, once the apples are waxed, they are more expensive and I am not sure a fresh-cut processor would like to pay any more than need be for their raw product. As a consequence, I recommend the use of graded, but unwaxed apples for fresh slicing.” (E-mail correspondence 3/20/05)

At the same time most of the apples being used for slicing are waxed because most apples sold domestically are waxed.

#### **4. Skin and color requirements**

There are no standard specifications for skin or flesh color. Some processors feel it is important to have white-fleshed slices rather than yellow. One local fresh cut processor said that while they felt leaving the skin intact was a plus for consumers who distinguish sweet or tart by color and made the slices a more appealing product, color was not important. Another processor indicated mixed colors had greater consumer appeal; while another felt that colors offered product line extensions: reds, greens, and mixed. McDonald’s is using both sweet reds and tart greens in their Waldorf salad.

Whether to peel the apple is partly an equipment issue as the machinery to peel, core and slice is more expensive than those that simply core and slice.

Leaving the skin offers a consumer health benefit of fiber and cancer fighting antioxidants. (Dottinga 2004) Adults concerned about healthy eating would likely prefer a slice with the skin intact due to the beneficial properties found in the skin.

Removing the skin provides access to a more diverse foodservice market for pies, pastries, etc., as well as an ability to target consumers who object to the peel. For example, the extensive test market research conducted for Mc Donald’s Apple Dippers targeted at children resulted on a skinless slice (in part a least because of concerns that the skin might be a choking hazard). Foodservice targeted at seniors may prefer a skinless product. A peeled product would create market opportunity for apples with blemishes, scab or first quality apples with less than perfectly colored skin. For organic production, peeling could be a plus.

A fresh apple slice company would want to evaluate product market diversity versus processing cost.

#### **5. Whole apple value**

Apple slices require the highest valued apple. Pries are market determined and vary greatly from season to season.

Processors working under contract to Mc Donald's source apples from NY, Michigan and the west coast. When eastern processors buy western apples they are paying for \$4- \$5 of transportation charges and the apples are riding in refrigerated trucks for several days. If we can deliver a similar quality apple for the same or less cost we can be competitive, especially in an industry that requires the freshest product to quickly convert to slices.

Large vertically integrated apple growers in the west have a value-added advantage in slice production. These companies avoid broker and sales commission costs of sourcing and have lower raw product transportation expense.

As consistency of peel color is less obvious in slices vs. a whole apple, this product presents opportunity for less than perfectly red apples that are discounted in the fresh market.

#### **6. Condition of fruit (brix, pressure, acidity)**

Apples for slicing should have consistency in brix (min 10 and 1/2), acidity (malic acid) lower than 4.5, and firmness, 15 lbs. pressure and up.

### **b. Raw Product Procurement**

Most New England slice processors are buying western apples (Champlain Valley is the exception as they buy NY apples). In at least one case apples are bought through the Boston terminal market; in other cases purchases are made through brokers and by contract with wholesalers and growers.

Apples are purchased by contract price or by current market price. Processors require just-in-time delivery.

### **c. Handling from Raw to Finished Product**

Apple slices lose quality due to moisture loss from skinless surface areas, biochemical changes and initial microbial load and growth. Proper management of production processes and temperature controls are critical to success. "A premium quality end product starts with premium quality raw materials. Good manufacturing practices and strict hygiene should be applied with the implementation of HACCP systems to assure microbial safety." (Verlinden and Nicolai 2000. P. 218)

#### **1. Cold Chain**

Apples should be kept at 32 to 36 degrees F (some processors allow up to 40 degrees F and never above 41 degrees) from wholesale storage, while on refrigerated trucks to processor storage to the processing floor and during processing, to storage of finished product, through transport to retail or Foodservice customer, who in turn must keep the product refrigerated. Even packaging materials have to be kept at cold temperatures. Temperature recorders, monitoring devices, management systems trained monitors are an integral part of plant design and operation. Most processing rooms are kept at 45 to 50 degrees F.

This is a business that requires strict cold chain control. Distributors, retailers and foodservice customers must be educated to ensure proper temperatures are maintained or product quality will suffer. For example in a product-scouting trip to Hannaford's, poly bagged sliced apples (CrunchPac) were displayed on a shelf above the produce case under store lights at room temperature. While the package indicated 4 more days of shelf life, the slices were starting to turn soft, the skin was separating from the apples, brown spots were evident and the interior of the bag was developing a mushy film. Retailer handling, resulting in a failed product and a turn off to a potential customer ruined all the effort the company had put into the product.

The fresh cut companies in New England that we have interviewed use temporary employment services as demand for fresh cut products varies through the year. An apple slice business will need to balance staff to supply/demand cycles.

## **2. Regulatory, record keeping requirements**

Processors must have Hazard Analysis Critical Control Point (HACCP) plans and procedures in place and use Good Manufacturing Practices (GMP) to assure proper food safety. Growers should have Good Agricultural Practices (GAP) programs in place, use and monitor them to reduce opportunity for food safety risks. The plant should have an allergen control program, cleaning and sanitation programs, a pest control program and a system for recall. Once programs and systems are in place, monitoring, evaluation and training must be on going.

Processors who contract with suppliers can always trace product back to the source. Others who buy on price in a terminal market cannot easily trace back to the source.

USDA ARS has published a “Guide to minimize Microbial Food Safety hazards for Fresh Fruit and Vegetables” that ‘describes good agricultural and management practices for growing, harvesting, washing, sorting, packing and transporting fruits and vegetables.

## **3. Packaging criteria for delivery of raw product to processor**

Currently most raw product ships in non-returnable one-use type corrugated boxes. Tray cartons are preferred over cell boxes due to ease of emptying apples and reduced waste. At some point growers may want to switch to reusable containers (less waste). In fact some processors are encouraging this. The fruit is pre-sized and graded and packed in sanitized plastic reusable 20-bushel field bins by the grower. Because of the potential for bruising, apples should be packed in trays or individual cells. Orchard run may not be desirable due to variable apples sizes and increased potential for bruising.

## **4. FDA Labeling, state/federal licensing**

The label should list ingredients, as in fresh apples, and the type of preservative as in calcium ascorbate, citric acid and calcium chloride. Need to check GRAS requirements.

Because shelf life is related to quality, not food safety, the Food Safety and Inspection Service (FSIS), does not require product dating for apple slices. Shelf life is determined

and provided at the processor's discretion. The "best if used by" date is a buyer guide to quality. (Rodriguez [www.fmssinc.com](http://www.fmssinc.com), [www.fsis.usda.gov](http://www.fsis.usda.gov)) Currently most processors use about 21 days as the longest sell by date; variety, fruit ripeness, anti-oxidation process and packaging all influence shelf life.

#### **d. Processing Stages**

Producing high quality apple slices with a minimum 14-day shelf life is a rigorous and very demanding undertaking. Those in the industry say it can take up to three years of R & D to get the facility, equipment, process/packaging, and varieties right.

Apples vary by variety and by how the variety ages in storage. These factors affect sugar content, firmness, stage of ripeness and susceptibility to softening and browning. Fresh picked apples and apples coming out of storage in February through May present different issues for different cultivars. [NOTE: apples that have been in storage for more than a year are the least susceptible to contamination due to reduced sugar levels...on the other hand they don't provide much in the way of sweet, crisp taste!]

Browning occurs at cutting from exposure to air or secondarily from microbes introduced in processing. Cut surface browning can be controlled by various treatments; secondary browning cannot. Secondary browning can develop from cross contamination from pathogens in calyx or on the stem, bruised or decayed fruit on the core/slicer, on the processing line, in sanitizing and anti browning washes. Consequently processors should use only top quality fruit, pay detailed attention to sanitation systems and use low volume sprays rather than dips. (Toivonen et. al. 2001. Toivonen interview 3/2005. See Appendix. Exhibit 2: Toivonen Slides, 2005) White room processing is critical to success.

Apple slices are a just-in-time business. Apples should be processed and shipped as soon after raw product delivery as possible. In addition to maintaining near-freezing temperatures, the air in the processing room should be filtered to keep the space clean and free from airborne microbes. Personnel should wear hats, hairnets, gloves, smocks and masks; gloved hands should be washed before working on the line; and boots should be dipped in an anti-microbial bath prior to entering the processing room.

##### **1. Sanitizing of raw product**

The main purpose of this stage is to minimize the microbial count on the whole apple prior to slicing. This reduces the possibility of contamination transferring from the calyx, stem, core or peel to the slice by the slicing equipment. Most processors use a chlorine bath or drench. Water temperature and pH must be carefully monitored.

Whole apples should be stored in a separate room and thoroughly washed before they enter the processing room.

## **2. Peeling/slicing**

The primary goal of this stage is to slice and sometimes peel the apple. It is essential to have sharp blades that can be cleaned easily and safely. Internal quality of the apple must be exceptional. An apple less than 15 lbs will be susceptible to breakage and bruising. Hand or automatic slicers are acceptable.

## **3. Clean/sanitize sliced apple**

Once the slices have been cut a water spray wash to remove the small apple “bits” is highly recommended. A sanitizing agent (e.g. chlorine or ozone) is added at this step.

## **4. Application of anti-browning coating**

All packaged apple slices that will be consumed fresh (not cooked) undergo an anti-oxidation treatment; every anti-oxidation treatment system is proprietary and not available in the public domain. Some systems submerge fresh cut slices in the anti-oxidant solution; sometimes the solution is sprayed on the slices; other times it is a combination of both. Coatings are somewhat similar in that they generally use ascorbic acid combined with other vitamins and minerals. Packaging types and regimes afford further protection.

NatureSeal was developed from a cooperative research and development agreement between USDA ARS and Mantrose-Hauser Co., Inc., to commercialize a blend of FDA approved vitamins and minerals that keep refrigerated sliced apples from turning brown for up to three weeks. The scientific breakthrough made by ARS was that certain calcium salts could protect apple slices from changes in color, taste and texture. NatureSeal is a powder that is mixed with water. ([www.ars.usda.gov/is/AR/archive/oct00/apple1000](http://www.ars.usda.gov/is/AR/archive/oct00/apple1000)). NatureSeal formulations are available for organic apple slices and for slices that will be used in pies and other cooked products.

Generally the coating process is accomplished by dipping apples slices into a tank or by using a low volume spray. The amount of product taken up by the slice varies with cultivar. Processors indicate that the product is expensive, as much as 10% of the finished cost; as a result many firms have developed their own proprietary coatings. Greater economies of scale are achieved with volume.

Coatings can affect flavor. Milder apples such as Gala and Fuji are more susceptible to developing an off flavor while a strong flavored Granny Smith is less likely.

Apples slices are then air-dried. Sanitation applied after this point would dilute the coating so is not recommended.

There are other anti-browning methods besides NatureSeal. Working with scientists at the Geneva NY Agricultural Experiment Station in the 1990's Cahoon Farms in NY developed a “dip of 80,000 ppm of Vitamin C to prevent browning and contamination by microorganisms, followed by a unique method of blow drying and quick cooling that increases the efficacy of Vitamin C on the surface of the apple slices. The process

improved the appearance, maintains apple texture, extends shelf life to about three weeks, and maintains the nutritional benefits. Because ascorbic acid is so expensive, food scientists also had to develop a way to pasteurize the Vitamin C dip solution so it could be re-used in processing.” ([www.nysaes.cornell.edu/pubs/press/1998/appleslice.html](http://www.nysaes.cornell.edu/pubs/press/1998/appleslice.html))

A New Zealand company is marketing Fresh Appeal, a technology that promises a 21-day shelf life for apple slices. The natural method employs a “disinfection process to wash the sliced produce and kill pathogens that can discolor and spoil the fruit.” (*Financial Times* 2005) Their technology uses a UV light to kill pathogens (99.9% kill rate), followed by a heat to penetrate the slice to kill subsurface contamination, finished by instant cooling to extend shelf life.

FreshXtend Technologies in Vancouver CA specializes in fruit and vegetable shelf-life extending technologies that are all natural and work without the use of preservatives or additives. FreshXtend markets antioxidants, FreshSpan, Maptek Fresh and UFB technologies. The company designed the line and systems for Country Fresh’s apple slice products (see Competition section). ([www.freshxtend.com](http://www.freshxtend.com)).

The company uses MAP Technology defined as the " ‘packaging of a perishable product in an atmosphere that has been modified so that its composition is other than that of air.’ (Ellis Horwood). Within the packaging, a gaseous environment consisting of a product specific concentration of oxygen (O<sub>2</sub>), carbon dioxide (CO<sub>2</sub>), and nitrogen (N<sub>2</sub>) exists (normal atmospheric gases). This environment reduces the rate of respiration and ripening while reducing the growth rate of microorganisms. When correctly used, MAP can greatly increase the shelf life of perishables.”

FreshXtend’s MAP technology trademarked as Maptek Fresh™ is a post-harvest biotechnology consisting of a series of inter-related product-specific procedures which, when appropriately selected for each type of product, stabilize the produce and place it in a state of hibernation. This condition allows the produce to retain its quality, ripe-harvested and fresh characteristics over an extended period. The process allows the product to go into a state of hibernation through three product-specific components ([www.freshxtend.com](http://www.freshxtend.com)):

- a) An impermeable cup, therefore impermeable to the exchange of gases;
- b) A clear, semi-permeable film used as a seal, which allows for the proper exchange of gases for the fruit to respire;
- c) A vacuum sealing process whereby air is removed and a gaseous combination of oxygen, carbon dioxide, and nitrogen is inserted.

Edible film made from fruit purees is another emerging approach that shows promise for apple slices. The technology is being developed by ARS researchers at the Western Regional Research Center in Albany CA. ([www.scienceblog.com](http://www.scienceblog.com))

Scientists at Oregon State University, USDA ARS Citrus and Subtropical Products Center in Wenatchee, WA, the Beltsville MD Agricultural Research Station, the Eastern Regional Research Center in PA and Canadian universities in BC and Ontario are conducting apple slice treatment research to better understand and improve existing methods.

Because browning characteristics differ among apple cultivars, anti-oxidation formations are prescribed per variety. Researchers in Canada are currently evaluating some cultivars that are naturally more resistant to browning. Cornell is also doing work in this area.

## **5. Packaging**

A plethora of packaging methods are currently in use today, both flexible and rigid. Because the chemistry of apples is variable (respiration rates vary by cultivar and age), there is no perfect package (see Appendix, Exhibit 2. Toivonen 2005 slides). Packaging needs to be matched to Oxygen Transpiration Rates (OTR) when selecting film material. If oxygen levels get too low, off flavors will develop from anaerobic respiration. A range of 2-5% oxygen is recommended.

Knowing that packages may not be handled with optimum care and under optimum temperature conditions once they leave the processor, package design must be able to withstand such abuse. (Toivonen et al. 2001) Since packaging film can be as much as 100 to 200% different from the manufacturer's specifications, package testing is critical. (Toivonen et. al. 2001)

Most processors are using polyethylene bags, most likely because at 2 to 3 cents per unit, they are the most reasonable. A rigid clam shell (polystyrene) provides more protection for the apples for 10 to 25¢ per unit. Some permeability of the clamshell is needed (a pin prick) to prevent off-flavors.

A method developed by Reichel Foods combines a thermo-formed tray, utilizing gas injection and a heat sealed film provides an excellent package. When combined with anti-oxidant spray, a 42-day shelf life is possible.

Cahoon Farms, a New York-state grower and manufacturer of fresh and frozen apple slices worked with the Geneva Agricultural Experiment Station on a Modified Atmosphere Packaging (MAP) that along with natural methods to prevent browning (spraying with vitamin C and nitrogen flushing) can package apple slices with a shelf life of 28 days (from production, under refrigeration). (Rodriguez [www.foodproductdesign.com/archive/2002/0702SEN.html](http://www.foodproductdesign.com/archive/2002/0702SEN.html))

The International Produce Association market trends study notes that “packaging is more than a box or a bag; it’s a full partner with the product, and there are few product/package combinations out there where that is truer than in fresh-cut produce.” (*Fresh Cut* November 2004)



## **6. Waste generation and disposal**

An apple slicing plant will generate waste packaging material, wastewater, cores, peels and poor slices. Fruit waste can be handled by automatic waste handling systems that incinerates, filters and discharges into the municipal sewer system; by landfilling or by composting. Fruit waste can be sold as livestock feed.

Cardboard can be packed for recycling. Reusable raw apple shipping cartons would significantly reduce waste generation.

## **e. Regional and National Co-Packing Facilities in NE and the Northeast**

See Competition Section for info on Frosty Fresh/Jard Marketing, Haverhill MA, Del Monte Fresh, Canton MA, Champlain Valley Specialty of New York, Inc., Keeseville NY and Reichel Foods in Rochester MN.

We worked with **Champlain Valley Specialty of New York, Inc.**, Keeseville NY to process slices for test markets of a New England product at the Big E and in VT, NH and RI schools. The facility produced an excellent product; principals were easy to work with and enthusiastically embraced a New England venture. We strongly recommend the development of this co-processing opportunity.

## **f. Requirements and Costs for an Apple Slice Processing Facility**

This information reported here is based on consultations with fresh cut equipment manufacturers, anti-oxidant suppliers and sliced apple processors, observations of fresh cut and apple slicing facilities and from the Wisconsin Fresh Cut Produce study (*Preliminary Feasibility Study of a Fresh-Cut Produce Processing Facility for Madison, Wisconsin* 2004). All sources report that the manufacturing process is extremely challenging, requiring a substantial investment 1) in the processing facility, to assure maximum apple quality from receiving through packaged product shipping, with special attention to stringent control of apple, air, facility, staff and equipment cleanliness and 2) in equipment, to assure maximum yields, proper handling and packaging.

Most facilities process other products besides apples (i.e. carrots, grapes, etc.) to assure the overall economics of the infrastructure investment and the business. As in the case of McDougall Orchard in Maine, it is unlikely that an apple producer would be able to develop a large enough market for apple slices, quickly enough to warrant the facility and equipment investment. The best opportunity is to develop a business relationship with an existing apple slicing or with a fresh-cut processor.

## **1. Facility Requirements**

At minimum, an apple slice production facility would include:

- Loading Dock
- Refrigerated Whole Apple Storage Room
- Apple Wash Room
- Processing Room
- Boxing Room
- Finished Product Storage Room
- Shipping Area
- Shipping Dock
- Maintenance and Sanitation Materials Storage Room
- Packaging Materials (film, cardboard boxes, sealing tape, labels etc.) Storage
- Laboratory
- Office
- Employee Lockers, Break Room
- Rest Rooms
- Septic System or Sewer Access
- Solid Waste Disposal System
- Water Source
- Parking and trailer truck turning/access

The size of the Whole Apple and Product Storage Rooms are related to the ability of the facility to work on a just in time basis. Facility planning should consider how future expansion will be accommodated and be able to utilize multiple shifts and associated storage for inputs and outputs.

Apples may be delivered in bulk bins, provided the fruit is graded, sized and gently handled. Bins may need to be sanitized before filling. Otherwise apples should be delivered in disposable corrugated boxes.

To assure apple quality, appropriate refrigerated conditions must be maintained from the moment cases are received from the trucker, inspected, added to inventory and delivered to the storage room. Apples can be held at the plant in refrigerated storage for a maximum of two weeks.

For maximum cleanliness, the production part of the apple slicing facility needs to have separate rooms for refrigerated storage of raw apples, washing and for refrigerated processing. The storage system must ensure that apples are sent to the processing room on a first in, first out basis. Whole apples can be stored up to two weeks before processing. Slices are made from premium extra-fancy to fancy 2 3/4 – 3-inch apples.

The processing room must be equipped with an air purification system, sealed floors, Kem-lite wash-down walls and ceilings, and be maintained at 45 to 55 F. Floor drains for gray water are connected to approved septic or sewer systems. All lighting has to have guards to protect food products from bulb breakage. To reduce/prevent infiltration of contaminants, air

entering the processing room must be filtered; a positive air pressure should be maintained at all times.

Apples are taken out of cases and washed in a separate room equipped with washing tanks and a chlorination system (\$10,000 to \$15,000).

From equipment choices to construction materials, all aspects of facility planning should assess and include energy efficiency. As noted in the Wisconsin study (pages 42 -43):

Efficiency measures should be incorporated into the planning and design of the facility wherever possible. For example, Harvest Freshcuts, a leading fresh-cut company in Australia, saved over \$80,000 in the first 15 months after installing a number of ecoefficiency measures at their plant. Some of the measures that have been installed or are being considered include:

1. Increasing the volume of internally recycled water (\$22,000 annual savings)
2. Fitting efficient spray nozzles to hoses
3. Redesigning wash systems to reduce quantity of sanitizing agent used (\$15,000 annual savings)
4. Installation of a chill recovery system, which uses chilled wastewater from wash lines to pre-cool the town water supply (projected annual savings of \$8,700)
5. Installation of high efficiency air compressors (projected annual saving of \$10,000)

## **2. Plant Size**

Based on industry consultations, a New England regional plant would produce from 500 up to 1000 lbs. of finished slices per hour. The facility would need about 7500 square feet. One approach to getting into business would be to co-process slices in an existing or cost-effectively adapted facility until market demand warranted investment in a plant. Another option would be to build a small pilot facility designed for expansion.

## **3. Plant Costs**

### **a. New Construction**

Until the facility is fully planned and designed, it is difficult at best to project costs. We are assuming a 7,500 square foot facility capable of producing up to 1000 lbs. of slices per hour. Estimates from contractors and those in the fresh-cut industry suggest the cost of building a new processing plant with all the above elements ranges widely from \$70-\$95/sq.ft, plus the cost of land, site development and equipment. Constructing a 7,500 square foot building could cost from \$525,000 to \$712,500. Equipment would at minimum add another \$430,000.

### **b. Retrofit**

The cost of retrofitting an existing building is even more difficult to project. Growers may want to seek out a produce distributor with some fresh cut processing in place to explore a co-venture.

#### **4. Yield**

Yield from whole apples ranges from 65 to 75%; larger apples have higher slice yield percentages. Slicers prefer apples 2.75 to 3 in. diameter with flesh firmness of 15 pounds or higher when measured using a penetrometer. Final packaging also influences yield. An 'extra' wedge needed to make the minimum package weight is more costly if the extra wedge is from a larger versus smaller apple. For example, if you need the equivalent of a small wedge to make the package weight and have to use a large one, the package is over weight. Multiplying the give away weight by hundreds to millions of packages amounts to a significant reduction in yield overall and a significant dollar cost.

Some manufacturers deal with this problem by using a 'fixed' volume container, which is matched by slice size to obtain the ideal weight. This system requires planned consistency in apple size. The resulting package looks full and has just the right weight with out adversely affecting yield. Obtaining consistency however adds to procurement specifications and increased apple cost.

#### **5. Sanitizing**

Care needs to be taken during sanitation to prevent bruising. The basic method is to carefully float or dip apples in a tank of water. This requires a stainless steel tank and the ability to control water temperature and the pH of the sanitizing solution particularly if using chlorine bleach, and a means of metering or measuring the chlorine bleach. An observed system used 70 F water, 50 - 100 ppm chlorine and pH 6.5-7. A Tew manufacturing Corp. (Penfield NY 585-6120) washer and absorber costs from \$3800 to \$5000. (See catalog) Chlorine costs @ \$400 per month. A conveyor is needed to handle slice output volume requirements.

A more advanced method uses a chlorine dioxide drench. This system requires pumps, injectors, brushes to apply, a water rinse to remove and an air dryer and is estimated to cost \$5000 to \$15000.

Another option is an ozone or ultra-violet sterilization system. We did not find any processors using either of these methods. Ozone can corrode processing equipment; the effectiveness of ultra-violet systems can be reduced by cloudiness in the water. The expense of these systems makes them not cost effective for all but the largest volume facilities.

#### **6. Coring and Slicing**

After the whole apple has been properly sanitized it travels via conveyor to the coring and slicing table. A high quality slice requires high quality, very sharp and gentle, stainless steel blades. Most processors use a hand-operated cutter for maximum quality and yield. Excessive movement or pressure by the operator can cause a slice to bruise and brown even before the anti-oxidant is applied.

A manual cutter available from Jarvis Products Corporation (Middletown CT. 860-347-7271) is capable of 250 to 300 strokes per hour depending on the skill of the operator, or approximately 500 to 700 whole apples per hour (13 to 18 cases (@37 lbs. each). One bushel of apples at a 65% yield produces @ 24 lbs of slices; at 75% yield, @ 28 lbs of slices. Slice

output could be from 300 to 500 lbs of slices per hour. The cutter is priced at \$6,500 depending on choice of blade and will process apples up to 3.3 inches (80's). (See also literature from Jarvis, Atlas Pacific, Pease and Bock Engineered Products). A 1000 lb. hourly out put of slices would require two slicers.

## **7. Slice Treatment**

Apple slices are sprayed to remove small pieces created in the cutting process. A sanitizing agent can be applied at this stage, again to ensure maximum protection from microbial agents. A shakable screen or mesh conveyor can be to remove pieces and excess water.

Once sanitized, the slices are ready for dipping into a tank or trough of a liquid anti-oxidant solution. Care must be taken to ensure proper concentration. A filtration system will maintain temperature, and remove small particles and microbes. Finished slices are cooled, excess treatment solution shaken off, spin dried, or cool forced air-dried. Slices are then packaged when dry.

In some installations the fresh slices are sprayed with anti oxidants on a belt conveyor. Whoever the processor is purchasing antioxidants from will specify concentrations, time of exposure and the best equipment for the application. This kind of information is not publicly obtainable since each manufacturer considers the application system for their anti-oxidant as proprietary as the formulation. Thus costs can vary considerably.

Fresh Appeal of New Zealand has developed an automated process, which disinfects and treats apple slices in a fully self-contained and automated system using unique proprietary technology. Currently there is only one commercial unit in production, located in Ireland. The system employs a turbulator for ultra-violet surface disinfection of the freshly cut slices and then exposes the slice to a high temperature for a short time, allowing penetration through the apple skin to the flesh, followed by a rapid, near freezing chill. This virtually guarantees a 99.9% kill rate across the full spectrum of micro-bacterial contaminant found on apples. And it produces a superior (according to the company) fresh, crisp slice with natural aroma characteristics with a 21-day shelf life. The system processes one ton of sliced apples per hour (32,000 oz.) the equivalent of 16,000 two-ounce bags. The complete system, estimated at \$500,000 (see e-mail and CD), does not include cutting and packaging equipment.

## **8. Packaging**

Apple slices are typically packed in clamshell units, film packs and poly bags. As the latter are less expensive and especially well suited to the school lunch program, poly bags appear a reasonable option. The form, fill and seal packaging machine needs to be coupled with an automated weighing feed system. Not only is this one of the more costly equipment items (some models cost as much as \$350,000), it must be kept in top working order. Breakdowns and inaccurate weighing can add considerably to production costs.

If clamshell packaging is used it is possible to fill the containers by hand on a scale to exact weights. As volume increases an automated system for filling and weighing is preferable. Some means of applying a tamper-proof seal is needed.

## **9. Solid Waste Disposal**

The organic and paper waste generated by the facility can be recycled to minimize environmental impacts and to obtain production savings. A more expensive and less environmental sensitive option is to landfill this type of waste.

Apple cores and pieces can be composted for use by homeowners, landscapers, farmers and gardeners. In some areas apple waste can be used as animal feed.

## **10. Water**

A facility of this size could use up to 20,000 gallons of water per day.

## **11. Major Equipment.**

This is not a complete list of all the equipment needed to operate a processing plant, but an estimate of significant pieces of equipment.

<u>Item</u>	<u>Cost</u>
Refrigerated storage	10,000
Washing system	15,000
Conveyor (slices to anti-oxidant)	10,000
Cutter (s)	20,000
Conveyors (2, computerized/integrated with packager)	50,000
Treatment system	15,000
Spinner/dryers	15,000
Packager (2 form fill and seal machines)	295,000

## **2. Distribution System**

Interviews with produce distributors revealed no product specific issues other than the need to maintain strict cold chain performance from the processor to the distributor to the end market. A 21-day shelf life is a challenge, but produce distributors are used to dealing with perishable commodities.

In conducting test marketing for schools, organizing deliveries from the processor to the Boston terminal produce markets as back hauls to whole apple deliveries proved possible and economical. Distributors were able to efficiently acquire cases of slices along with other produce, transport to their warehouses and deliver to customers within a couple of days of processing. Other than refrigeration, sliced apples presented no special requirements that would hinder or prevent their being distributed through existing channels. Cases need to be clearly labeled with handling, storage and merchandizing information to assure the product is held under

ideal refrigerated temperature conditions at all times and is not thrown or shaken. Order management is critical to success.

As for retailers, while once a week is typical since slices now are coming from the west coast, preferred delivery is two times a week to ensure the product stays in code. While not a distribution problem *per se*, the challenge of maintaining proper temperature in produce displays under bright supermarket lights has the potential to reduce shelf life. A New England produced product would have a distribution advantage if timely deliveries to warehouses can be accomplished. Retailers also noted that consumers would respond better to a New England product because it would be regarded as fresher. Because People know apples get brown when sliced, they tend to get suspicious of a sliced apple that has traveled all across the country. The “what’s on it?” question will need to be address by packaging and POP materials.

### 3. Market Analysis

#### a. Market Environment: Fresh Cut Trends

□ An International Produce Association study estimates the pre-cut, pre-washed packaged fruit and vegetable market at \$12 billion in annual sales and growing. The emerging fresh cut fruit segment accounts for \$300 million in annual retail sales and is projected to exceed \$1 billion with in the next 3 to 4 years. The report “Fresh-cut Produce Fuels an America On -The-Go” calls fresh-cut fruit “the candy of the produce world. People don’t need to be talked into eating fruit; it’s just naturally good eating.” It goes on to underscore the industry’s key manufacturing challenge: “processors are working with a living, breathing, organism whose spoilage-spiral begins upon harvest. From that moment, a race ensues to deliver a fresh-cut produce item at or near its optimum quality.” (*Fresh Cut* November 2004)

The report recommends that processors (*Fresh Cut* November 2004):

1. “Focus on the customer, the right customer.”
2. “Tell them about fresh-cut.”
3. “Give them new things to try.”
4. “Deal with success as fresh cuts move center-plate and center-stage.”
5. “Shorten the supply chain to keep the ‘fresh’ in fresh-cut.”
6. “Create offerings for different retailing and foodservice channels.”
7. “Think out-of-the box about packaging.”

□ Smaller households, aging population, higher incomes, two wage families means more consumption of convenient, ready-to-use produce according to a study by The Freedonia Group. (*Fresh Cut* October 2004)

□ *The Packer* 2/28/05: New Fresh Trends research conducted by Vance Research Services, a division of Vance Publishing Corp., Lincolnshire, Ill., publisher of *The Packer* found:

\* About three out of four consumers either prefer convenience packaging for their produce or at least sometimes buy it.

- \* An additional 8% either only buy fresh-cut and other convenience produce if it's available — or they only buy it, period. And only 17% of those polled said they don't usually buy convenience produce items.
- \* Almost one in three of those polled said they eat more fresh-cut produce now than five years ago. Just 5% eat less.

The focus group component of the research found that 55% of consumers would pay more for convenience produce items, and an additional 21% agreed with this statement: "If it's something I want, price is not a factor."

- \* 18% said they would not pay more for fresh-cut and other convenience items.
- \* Among those consumers polled who said they don't usually buy convenience items, 60% said the main impediment was price.
- \* Pointing to barriers to consumer acceptance, "sliced apples and peeled, sliced or diced potatoes were among the less popular items, each attracting the interest of fewer than 25% of those polled. "I'd be afraid they would turn brown very quickly, and be a waste of money," said one focus group participant. (Feb 25, 2005)

## **b. Consumer Responses to Sliced Apples**

□ A nationwide telephone survey of **women** was conducted for the New York apple study, *Thinking Afresh About Processing: An Exploration of New Market Opportunities for Apple Products* to understand more about fresh and processed product apple use and assess reaction to new apple products. One of the new products interviewed discussed was apple slices. The survey was followed by focus groups with women consumers and with foodservice chefs. (See Appendix. Exhibit 3)

The national survey revealed that 91% of the women had purchased fresh apples or apple products in the past 3 months. 62% reported buying both categories, 20% had purchased only fresh. Apple purchases of both categories were slightly higher for households with children (93%) vs. those with out (87%), slightly higher for dual income households (94%), and slightly lower for women aged 18-24 (87%)

Fifty-one percent of the respondents said they had purchased fresh apples for eating only, 30% for eating and cooking. Women 18 to 24 were less likely to purchase fresh apples (65%) while women over 65 were more likely to buy fresh (89%). Women with higher household incomes, over \$25,000, were more likely to buy fresh apples (85%) than women with lower incomes, less than \$25,000 (77%). Households with children had higher incidence of fresh apple purchases (86%) than those with out (79%). And women who had graduated from college were more apt to buy fresh apples (86%) than those who had attended, but not graduated (77%).



When the study looked at purchases for the sake of eating, not cooking, women aged 25 to 44 were the most likely buyers (60%) and those 65 and over less likely (45%), Women in metro areas were more likely buyers (54% vs. 44% for non-metro women) as well as those with household incomes over \$50,000 (60%) and a college education (57%).

Survey respondents were asked about interest in purchasing 15 new apple products, five were used fresh sliced apples; pre-sliced apples for eating or cooking, a snack pack of pre-sliced apples with caramel dip, a snack pack of pre-sliced apples with cheese and crackers, a snack pack of pre-sliced apples with peanut butter and a Waldorf Salad Kit with pre-sliced apples. The highest scoring product across the survey was the snack pack of sliced apples with caramel (22% said they would be extremely or very interested), followed by sliced apples for eating and cooking (21%) and the snack pack with cheese and crackers (19%). Scores for these products were higher for households with children and for black and Hispanic households. The difficulty in communicating new product concepts on the telephone could have reduced scores.

The survey was followed by six focus groups, each representing a different female demographic, to further explore consumer reaction to apples and to samples of prototype new products. Apple slices were included in all six groups. Regarding fresh apples generally (p.71):

In all of the sessions, most of the participants said that they eat fresh fruit at least once per day. All of the participants have been eating apples since they were children. Most of them believed that they eat the same amount or more apples, as well as other fruit, than they did five years ago. Several said that their increase in fruit consumption was related to their increased nutritional awareness.

Overall, apples are a traditional fruit that these women grew up with. They want to make sure that their children grow up with them as well. They find apples appealing because of their crisp, crunchy texture, juiciness, and their sweet and refreshing taste. They also believe that apples are “good for you” and good for their children.

The benefits and features of apples most participants liked were: Texture (crisp, crunchy), Juicy, Sweet or tart (most preferred sweet), Taste, Refreshing (cleanses palate, makes mouth feel fresh, makes your breath feel good, feels like I’m cleaning my teeth, my tongue, my insides), Good for you (healthy, nutritious, helps your teeth), Year-round availability, Variety of types, Diet Aid (low in calories, fills me up, takes craving away, curbs appetite, satisfying, takes time to eat, lot of chewing), Portable (ready to go, just grab and go, travel well, sturdy, easy to eat, not messy), Extended shelf life (do not spoil easily, keep for a long time), Versatile (chop in salad, cheese and crackers, fried, bakes ,apple pie, eat as is). (p. 72)

What didn’t they like? What would they change? (p. 74)

- Possibly unclean
- Browning
- Mushy
- Skin
- Core
- Messy

- Sticky
- Need to cut
- Seeds
- Stickers
- Wax
- Price
- Allergic reaction

The three largest dislikes were: oxidation of sliced and bitten apples, mushy texture and the peel. Regarding the skin participants commented (p. 75):

- .. “Gets stuck in my teeth”
- .. “It tickles the back of my throat”
- .. “Hard to digest”
- .. “The taste of the skin from the pesticides”
- .. “Thick, heavy skins”
- .. “Tough skins”

When asked what they might prefer in an apple, most agreed that apples were just fine, but when pressed said (p.76):

- .. “Skinless”
- .. “Easy to peel”
- .. “Thinner skins”
- .. “Coreless”
- .. “Seedless”
- .. “No wax”
- .. “Cheaper”
- .. “Won’t brown”
- .. “Pop-in-your-mouth’ size”
- .. “No stickers”
- .. “Full of calcium”

Only one out of the 48 women who participated in the six focus groups said she looked for the origin of the apples she was purchasing. (p. 77)

After a general discussion about apples, the focus group participants were presented a plate of processed apple slices prepared by the New York State Agricultural Experiment Station in Geneva. Because the reaction of the NY focus groups are of direct value to this project, a complete excerpt from the study discussing responses to the sliced apples is included in the appendix. This material is helpful not only to product idea formulation, but to the product testing planned for phase two of this study. It is important to note that the product used in the NY focus groups was perceived as being tart and thus may have affected results in that participants noted a strong preference for sweet tasting apples.

### **c. Market Opportunity: Retail Food Stores**

The response of the NY focus group participants clearly indicated a market opportunity for sliced apples and since most people purchase food for snacking and home consumption at supermarkets and grocery stores, food retailers are a key channel for sliced apple products. As noted in the Competition section below, retail sales are an important component of the marketing mix. Products vary from multi packs of small size servings e.g. five 2 oz. packages, to resealable packages ranging from 6 to 16 ounces for snacking, often combined with dips.

Interviews with chain and independent retailers in our region revealed some skepticism about whether and how well the product will go over with consumers. Produce buyers felt the product had yet to be effectively merchandized to consumers; people have not yet asserted a preference for slices. They also noted that a company that only marketed one item would be at a disadvantage over a company that was marketing a line of products.

### **d. Market Opportunity: Institutional Foodservice**

The New York study referred to above conducted focus groups with **institutional foodservice** (healthcare, schools, colleges, corporate) professionals to explore the same topics covered by the consumer groups: the use of fresh and processed apple products and reactions to new products. In the group discussions, foodservice participants noted that labor costs limit using apples more frequently. Browning limits use in salad and fruit bars. Those that worked in health care facilities noted problems with skins for older people. All but one of the participants was unfamiliar with pre-sliced apples for fresh consumption. After heating the product described, participant offered this comment (p. 112-3):

I did not realize that those apples, that you could get it sliced. I guess that I've never seen it. I think that's a good idea, the slice, as long as the shelf life is something that's realistic, and the price will have to go down. I suspect there will be a market for it because apples are popular and people would probably eat it. Even the nursing home patients, if it's sliced they could probably use it as finger food. It would still be difficult for them to chew but it would be easier, they don't have to bite into it. So I think there might be some opportunity for it.

When presented with the same apples slices used in the consumer focus groups, the Foodservice group reacted very positively citing potential applications (p. 113):

- .. "Salad bars have skyrocketed over the last ten years or so and just the ability to put this kind of product on a salad bar without it turning brown for even a short period of time will increase the volume significantly."
- .. "Think of the fruit and cheese platters that you could have more than just grapes on them."

Importantly for new product development insight, participants raised these issues (p. 114):

- .. What are the storage requirements?
- .. What happens if stored at higher or lower temperatures?

- .. Is a two-week product life long enough to ensure quality from processor to end-user?  
Can it be longer?
- .. Does the apple bake like a fresh apple, or is the water content going to need special consideration in baking recipes?
- .. Will it be affordably priced (i.e., comparable to fresh apples or other fruit substitutes)?
- .. Does the coating have potential side effects for people with allergies?
- .. Can the process be used to produce peeled slices, as well as unpeeled slices?
- .. Will it be available in shapes other than slices (e.g., cubes, whole peeled and cored, quarters, halves, rings)?

Institutional foodservice input was summarized as follows (p. 115)

- \* Apples and apple products compete with many substitutes for space on foodservice menus.
- \* Foodservice managers prefer to limit the number of suppliers that they use, and their distributors play an important role in deciding what food products are used in foodservice. This factor is a barrier to entry to the foodservice market for new apple products.
- \* Consistency of size, appearance, and quality are critical factors in selecting fruit products for foodservice managers.
- \* Labor constraints prevent institutional foodservice managers from using apples as much as they would like to on their menus. The oxidation and browning of cut apples also limits their use. These limitations point to an opportunity for a pre-sliced, non-browning apple product, and focus group discussions confirmed that this type of product could fill a need.
- \* The pre-sliced apple samples were well received by participants. They raised several questions about the product that identify potential opportunities to tailor the product to foodservice customer needs.
- \* These foodservice managers are always looking for new recipes and menu ideas. Recipe cards and suggestions for new product uses were suggested as a primary strategy to increase demand for a product in this market.

To assess how apples are used and new product potential in **independent casual and family style restaurant Foodservice operations**, the study conducted a series of telephone interviews. In general these types of restaurants were low volume users of apples. As with their institutional counterparts, labor constraints were a problem for some, as was browning. None had heard of a fresh sliced product and offered these reactions (p. 119):

- .. “I’d rather use fresh. We don’t have a high volume. If I was at a university or some other huge food operation, I couldn’t do what I do, but at my volume I don’t need to deal with processed.”
- .. “I would think it would be useful. Especially at many large banquet centers, they have their own bakers.”
- .. “I would have a tendency to say I wouldn’t use something like that. We’re dealing primarily with fresh produce, and I think that would carry over to apples. I find it difficult to believe that you’re not going to be leaching out some flavor.”
- .. “I haven’t seen [the product], but it’s definitely something I would take a look at.

- Something you've got to realize is there's a lot of waste, by the time you core the apple and take off the skin, there's a lot of waste. So that's something you have to consider, and the labor also."
- .. "I haven't used anything like that, but sure I'd try it if it maintained its flavor and texture."
  - .. "And for fruit salad, if apple was the only ingredient, but they would still be slicing all of the other ingredients, so I can't see it for our place."
  - .. "That's what I'm developing into with my other salads. My potato salad, we used to take the raw potato...I've got somebody walking in the door right now with a sample of precooked, peeled, diced potatoes, with a 28-day shelf life. But if I were dealing with apples to a point where I would have to take them like that, I'd do it. As long as you could pass them off as fresh, hell yes."

Three chefs from fine restaurants in Chicago were interviewed as part of a US Apple Association Meeting. For these establishments labor was less of an issue, and the quality and freshness of an apple for select and seasonal dishes was valued. As far as fresh cut was concerned they had "to feel that like they were not lowering their standards" if they used them. Market entry would be facilitated by the use of articles in trade magazines, sales meetings, information from distributors, chef-oriented websites and samples. Trade shows were deemed less effective.

#### **e. Market Opportunity: School Foodservice**

The school Foodservice director who participated in the NY focus group noted that (p. 112-3).

Once in awhile, when I can afford it, I'll get the sliced apple, like the Fuji apples in little packages, because the kids love anything that's prepackaged. If it's in a package and it's fresh, they really like that." She did not believe that the preservative that prevented browning on this product was noticeable in the flavor: "There was ascorbic acid, something like that that you can't taste."

The school foodservice market was explored by a survey mailed to members of the New York State Foodservice Association. The survey found that schools were using more fruits and vegetables and that the increase was greatest for fresh produce, substantial for pre-cut produce, and only slight for processed products.

Pre-cut apples had been served in about one quarter of the New York school districts in 2000. Pre-cut apples were regarded as slightly above average in nutrition, above average in price, and about average in appeal to students and staff. At its current price, many foodservice directors did not perceive the product to be a good value, feeling that its nutrition and appeal was not great enough to justify its premium price.

**That is not to say that opportunity is not present in school foodservice.** "In June of 2003, a team of NatureSeal and Nutri-Tech researchers conducted a nationwide poll of school Foodservice professionals responsible for feeding over 2 million schoolchildren at all levels—elementary, middle and high schools. 91% of the Foodservice directors surveyed said they

believed more students would consume a sliced apple rather than a whole apple.” (NatureSeal Press Release 1/14/2004)

A study conducted by the USDA Agricultural Research Service Children's Nutrition Research Center at Baylor College of Medicine in Houston, Texas of sixth, seventh, and eighth graders found that students who liked apples would not buy a whole piece of fruit because it was hard to eat or messy. Apple slices offered with a small side of caramel dip, however, were found to be more popular. (ASFSA 7/31/2003)

The test market conducted as part of the larger project for this study distributed sliced apples to schoolchildren in VT, NH and RI. Children gave the ‘Grab Apples’ an overwhelming positive response. Comments from Our Lady of Mercy School in East Greenwich were typical:

“The apples were crunchy”

“They were very fresh”

“I liked them already sliced”

“It was just the right amount”

“It’s fun to eat apples like that”

“I would like to eat these every day”

Schools in Laconia NH got rave reviews from kids when they combined a slice pack with cheese.

The opportunity in this market is to meet the price value challenge. Interviews with state school nutrition program directors indicated strong interest in the product. Schools are very much concerned about offering healthy food selections. Each state in New England has its own unique approach to school nutrition programs and in how they use/obtain surplus commodities through the Department of Defense.

Interviews with school Foodservice directors surfaced major concerns about “plate cost”, meaning that a 2 oz. fruit serving in excess of 21¢-23¢ would be difficult to include on the regular menu and would most likely have to be offered as an a la carte item. Directors also thought the product would go over best with elementary children. The 2 oz. portion size might be a bit small for older students. University Foodservice staff also was unsure whether the 2 oz. size was a good fit for their students.

#### **f. Market Opportunity: Buy Local**

Studies conducted in the New England States consistently find that significant numbers consumers in region want to buy locally grown food. Typical is a 2003 study conducted by the Center for Survey Research and Analysis at the University of Connecticut, that found:

Solid majorities in both Connecticut (78%) and Massachusetts (75%), report knowing that fresh fruits or vegetables were grown locally would make them more likely to purchase the produce. On average, residents of both states consider locally grown food to be not only healthy (CT-76%, MA-71%), but also fresher (CT-88%, MA-87%) than non-locally grown or produced food.

And in a 2003 University of Massachusetts Dartmouth study that included towns in southeastern MA and four RI towns, those surveyed said freshness and taste influenced their decision to buy locally grown or raised foods. For example, respondents are most likely to buy locally grown or raised foods because local products are fresher (87.5%) and because they taste better (70.0%).

Additionally, large proportions of residents in CT and MA favor supporting local farms and see it as a way to preserve the character of local communities. Likewise a 2003 NH study conducted for the NH Department of Agriculture, Markets and Food found that over 90% of those surveyed felt that keeping farms viable was important with almost all respondents (98%) agreeing that buying local produce was a way to keep farms viable.

To the degree that this product can position itself as a New England grown product whose purchase supports the local apple industry, it will gain some of the 'buy local' preference advantage.

## **4. Competition**

### **a. Processing Companies**

**1. Crunch Pak, LLC**, Cashmere, Washington, developed from Naumes Fruit of Medford, Oregon (began marketing apples slices in 2000), which formed a partnership with Dovex Fruit Company of Wenatchee and eventually sold its interest to a group of Washington fruit growers. The forerunning company, Naumes, used NatureSeal as the apple preservative; Crunch Pak now uses their own proprietary system. In 2001 while operating as Fresh Products Northwest, the product was recalled due to contamination with *Listeria monocytogenes*.

Expanded production facilities enabled the company to extend distribution from the West coast across the US and Canada. Dovex Marketing Company markets crunch Pak. The company sells direct and through brokers.

The product got a marketing boost when it was selected by the 2002 Olympics to sell the product at the Games. In 2002 the company estimated its market penetration at 25 to 30% of the nation's grocery business. At that time branded packages of fresh-cut apple slices were estimated at about 40 percent of its business; the remaining 60 percent was sold to retailers, fresh cut processors and Foodservice companies as three-pound bulk bags for repack. The company markets skin on, sweet and tart apples in 3 lb, 1 lb re-sealable, 7 oz. with a packaged caramel dip inserted loosely in the pack, and 2 oz. packages. The 2 oz. pack is targeted at school Foodservice. ([www.CrunchPak.com](http://www.CrunchPak.com))

The company is also marketing 1 lb bags of diced apples, including skin, for use by foodservice. Starting in April 2004 the company was shipping Arby's 20,000 pounds of diced apples a day for use in salads and chicken salad sandwiches. (*Fresh Cut* October 2004) Crunch Pak has developed partnerships with Earthbound Farms and Whole Foods to process and package organic apple slices.

Labels include UPC, Nutrition Facts, the 5 A Day Logo, a “Best if Used By” date and coding for traceability. The company describes its apple preservative as a “blend of calcium and Vitamin C to maintain their flavor and color. Once applied, the rinse keeps the apples crisp and flavorful for up to 21 days provided the fruit is maintained at 32-40°F.” The company uses mostly Pink lady and Granny Smith apples. ([www.CrunchPak.com](http://www.CrunchPak.com))

The 16-ounce bag of Granny Smith slices retailed for \$1.49 at Hannaford supermarket in Keene.

**2. Earthbound Farm**, the largest US grower and shipper of organic produce, partnered this year with Crunch Pak LLC (see above) to expand their ‘Healthy Snacks for Healthy People’ line of produce snacks to include apple slices. Crunch Pak processes and packages the organic Gala apple slices in two sizes: 12-ounce family pack with a \$2.99 retail; five 2-ounce mini-packs packaged together retail for \$3.49. The product has a 17-day shelf life. (Fresh Cut 2004; Deseret Morning News 2005) and labels use of Calcium Ascorbate, a blend of Calcium and Vitamin C to maintain freshness and color.

Products are sold to retailers as 8/12 oz. poly bags, 150 cases/pallet and 6 /5-2 oz. poly bags, 150 cases/pallet.

**3. Reichel Foods LLC**, Rochester MN entered the apple slice market in 2002 as an extension of its fresh cut and lunchables-type convenience food line, Dippin’ Stix. The company combines upscale packaging and processes to extend the shelf life of apple slices up to 42 days. Reichel dips slices in NatureSeal and puts them in a heat sealed, gas flushed package. The package holds the slices securely providing excellent protection against bruising and browning. The product was in perfect condition when purchased for this study and maintained its quality beyond the Best By date.

Two-compartment opaque white thermo-formed trays hold the apple slices in one section and various dips in the other: caramel, caramel with peanuts, peanut butter, or fruit mayonnaise (retails for \$1.18 in Wal-Mart). A clear film covers the tray; the consumer easily opens the film. The Dippin’ Stix Lunch Combination features the apple/dip combination tray along with another three compartment tray containing 98% fat free round turkey or ham slices, sliced processed sharp cheddar cheese product, and buttercrisp crackers (retails for 2 for \$5.00 in Wal-Mart). Trays are contained in colorful paperboard packaging with cutouts to reveal contents and illustrated with child and parent friendly fun facts and graphics.

The company also markets two products for Foodservice: a 26 oz. film covered round party tray of apples with either the caramel or fruit dip and a 4 lb. film covered rectangular bulk tray. Reichel does private label, co-packing, partnering and contract manufacturing.

Distribution is nationwide and across Canada. A major client is Wal-Mart. Apples are sourced from Washington and South America. Preferred varieties are Pink Lady and Granny Smith. The company produces slices on order with a one-week turnaround. The company finds Pink Lady is susceptible to secondary breakdown due to microbes late in the storage season. The company has



found that new crop apples are often the most difficult to process due to high respiration rates that allow higher growth of surface microorganisms.

In developing this product Reichel noted that research by the Washington Apple Commission found that 84 percent of consumers would buy sliced apples, and two thirds of baby peeled carrot buyers would prefer sliced apples as a snack item. ([www.foodengineeringmag.com](http://www.foodengineeringmag.com))

**4. Tree Top.** In June 2001, this apple co-op introduced fresh slices in a Tree Top brand retail test in June 2001. Tree Top sells slices directly to member warehouses, which sell to their customers. In 2002 the company noted the use NatureSeal and packs in 2 ounce, 12 ounce with or without caramel and 3 lb. bulk poly bags. A 14-day shelf life was indicated. (<http://www.rurdev.usda.gov/rbs/pub/mar02/apple.htm>; *Produce Business* 2003) NOTE: We have not found current data on Tree Top retail packs. The product is not listed on their web site.

Tree Top is one of the companies producing slices for McDonald's.

**5. TerraFresh,** Kingsburg, CA sells fruit to about 250 school districts in CA and another 10 in Florida, New York, Mississippi, Arizona and Texas. This newly re-organized company has seen 40% growth this year. Applesauce is made from post slicing/coring waste. (*Fresno Bee* 2005).

Their "biggest seller is the bagged half cup serving of sliced apples with a fat-free-caramel dip." (*Produce Business* 2003). The dip container is placed inside the bag with the slices. The company also markets a 4 oz Grab n'Go pack with a dip and 3.5 and 10-pound bulk bags. The company packages a grape and apple slice mix. Apples are preserved and bags are micro-perforated for a 14 to 21 day shelf life.

**6. Scotian Gold Cooperative Ltd.,** Coldbrook, Nova Scotia. Canada, a producer owned apple cooperative markets a 750 gram re-sealable poly bag to foodservice and retail for families, two Apple Snack Packs in 60 and 100 gram poly bags as well as a 300 gram re-sealable clamshell pack. "Real apples. Real Easy." ([www.ScotiaGold.com](http://www.ScotiaGold.com) )

**7. Farmington Fresh Sales, LLC** is a large refrigerated produce handling and airfreight operation formed by five fruit growers in 1995. It is located at the Stockton Metropolitan Airport, CA. The company markets Sweet Apple Bites and Foodservice Packs. They began selling bagged apples in 1998 and have seen annual double-digit growth. (*Fresno Bee* 2005)

The 2-ounce bags of Fuji or Granny Smith apples are packed 50 or 200 to the case. A caramel dip is available separately at 200, .5 ounce cups per case. Five pound bag Fuji or Granny Smith varieties are available peeled and unpeeled, 2-5 lbs. bags/case (80-1/2 cup (2 oz.) servings) or 8-5 lbs. Bags / case (320-1/2 cup (2 oz.) servings). Farmington Fresh has a 21-day shelf life. ([www.farmfresh.com](http://www.farmfresh.com) ) The company sells to schools, airlines and institutions. (*Fresno Bee* 2005)

The company promotes a convenient fresh picked tasting "All Natural, No Citric Acid, No Preservatives." apple. "It's an apple only easier. No more slicing, or coring. Just open the bag

and serve. The apples will retain their color after opening the bag for up to eight hours without browning.”

**8. FreshLand Produce** in Yakima WA positions their apple slice product as follows:

“Always on the go these days? FreshLand has the perfect snack for you. Whether at school, work, camping, traveling, or just at home watching TV, FreshLand's Fresh-Cut Apple Slices the perfect snack to go with you! FreshLand's Fresh-Cut Apple Slices are packaged fresh with no artificial preservatives. If properly refrigerated, they will stay fresh for up to 18 days.”

The company sells a 4 oz. Snak Pak, a 12 oz. Family Pak, and a 3 lb. Foodservice Tray.

**9. Yo Bites LLC**, a Yakima, WA partnership with connections to Zirkle Fruit, a major fruit production and packing company (the marketing entity for Ranier Fruit Co.), Price Cold Storage and a marketing consultant, makes “Apples with Attitude,” skin-on apple slices and dices. The company focuses on foodservice, noting “schools prefer fresh-cut apples over whole product because of reduced waste.” (*Fresh Cut* 2004) Their 2 ounce, 4 ounce and 3 pound bags have the greatest appeal to institutional customers; 1 and 2 pound bags are available, as well as special order bulk sizes.

The company is just beginning to develop the retail side of this business and is having success with a 1-pound re-sealable rigid container. Yo Bites feels the rigid retail package better protects the slices as well as being easily stored by consumers in the fridge and convenient to open and close. Sweet and tart slices are offered, with greater demand noted for sweet. Varieties are not promoted so that the company can change with availability of fruit. (*Fresh Cut* 2004).

The company uses its own proprietary sealing treatment. The anti oxidant wash contains ascorbic acid and does not need to be labeled as it is Generally Recognized As Safe (GRAS) product by the FDA. ([www.yobites.com](http://www.yobites.com))

**10. Snokist Growers**, a Yakima, WA cooperative has been in the sliced business for many years selling fresh and frozen sliced apples to bakers and Foodservice (industrial users). The company uses an ascorbic acid bath and vacuum packs in a 30-pound polyethylene bag. ([www.snokist.com](http://www.snokist.com))

**11. Gorge Delights**, Hood River, OR processes Gala apples for institutional and retail markets. Portland area schools have been their biggest customer. Individual servings are packed in rigid clamshell containers to assure better care and condition. The apples have a 14 to 21 day shelf life. (*Good Fruit Grower* 2003)

**12. Sunkist Growers** launched Sunkist's Fun Fruit for sale to schoolchildren last fall (September 2004). Fun Fruit packages come in five varieties: orange slices, or "Smiles"; apple slices, or "Grins"; seedless grapes, or "Giggles"; pineapple strips, or "Pals"; and carrot sticks, or "Kidders", are priced between 60 cents to 75 cents per bag and are being tested at school districts on the East Coast, including the Boston public schools system. The company is also exploring school vending machine sales. The single serving peel-and-open pouches are designed with kids

in mind. (*Tulare Advance-Register* February 18, 2005) Product development was supported in part by a \$450,000 USDA value-added grant. ([www.sunkist.com](http://www.sunkist.com))

**13. Cahoon Farms**, Wolcott, NY 14590 commercialized a modified atmosphere packaging system developed at the Geneva NY Experiment Station in the early 90's. In 1998 working with Tanimura & Antle, Inc. (T & A), the company was slicing Granny Smith, Empire and Gala apples, packaging them with either caramel or peanut butter dip in Bugs Bunny illustrated bags and selling the 2.4 oz. packs to schools in Dayton, Philadelphia, Grand Rapids, Chicago, Long Island and New York City. T & A no longer markets sliced apples, but rather uses the cartoon characters on carrots and celery packs while its parent company now slices apples for McDonald's (see Missa Bay and Ready Pac)

At the time Cahoon was also marketing their own Natures Pleasure line of fresh-cut apples in 2 oz, 8 oz, and 32 oz package of red and green apples of unspecified varieties. The larger sizes were targeted at families and Foodservice for apple pies. Also in 1998 the company had negotiated a contract with U.S. Airway to offer the 2 oz. snack-pak-with or without cinnamon-on flights from New York to Boston and Washington, and was negotiating a contract with U.S. Air Express out of Dulles.

In 1998 Nature's Pleasures was "packed using MapTek Fresh, a modified atmosphere packaging technology licensed from Pacific Asia Technologies of Vancouver, BC. The technology employs vitamin C and gives the apples a solid 14-day shelf life. Once the package has been opened, enzymatic browning is delayed for a minimum of 10 hours." ([www.freshcut.com/hortexpo/1998](http://www.freshcut.com/hortexpo/1998)) Nature's Pleasure now claims a month long shelf life.

Today the green skinned variety of Nature's Pleasures Fresh All Natural Apples Slices are contained in a colorful green bag and marketed to wholesale customers as "Slightly tart, all natural! Packaged in individual snack bags or bulk. Snack bags are 2.8 ounces of fresh, crisp, sliced apples in an easy-to-open attractive package. Ideal for kids and adults of all ages. Meets U.S.D.A. single-serve requirements of ½ cup serving." The red skinned variety comes in a red bag as "Slightly sweet..." ([www.naturespleasures.com](http://www.naturespleasures.com))

Key benefits are listed as:

- Natural fruit, cored and cut
- 21-day shelf life from date of processing
- Safe, sanitary, healthy snack food

The company defines its end consumer user as "the general consumer of fruit, ranging from the age at which children eat solid food to the broad base of the adult population. Purchaser demographic distribution is expected to land solidly among women with families, students and single adults in all households." The company expects the market for fresh slices "will increase wherever away-from-home meals and snacks that include produce are consumed. Our products therefore can be assumed to serve as a snack, a meal accompaniment, an impulse purchase alternative to candy, and generally as a more-convenient alternative to fresh fruit." ([www.naturespleasures.com](http://www.naturespleasures.com))

Wholesale customers include companies in the “candy/beverage/perishables convenience market channel, the foodservice & restaurant channels and the small office foodservice channel (vending/beverage service) where refrigerated products are marketed or supplied.” ([www.naturespleasures.com](http://www.naturespleasures.com))

Nature’s Pleasure notes that its quality 4-color packaging fits “well along side teas, fruit drinks, and carbonated beverage bottles and cans” and “conveys the all-natural characteristics of each variety, speaks directly to the convenience of each product and delivers a attractive, merchandisable "product billboard" that will draw eye-catching attention to shoppers visiting the refrigerated case, produce section or deli case where displayed.” ([www.naturespleasures.com](http://www.naturespleasures.com))

The company does private label and contract processing.

**14. Hudson Valley Farms Inc.**, Highland NY sells fresh cored, cored and peeled, sliced diced apples to bakeries. Slices are treated with ascorbic acid, salt or calcium chloride and packed in poly-lined 30-pound boxes. The product competes with frozen apples for market share. (*Hort Expo* 1998)

**15. Champlain Valley Specialty of New York, Inc.**, Keeseville NY completed a retrofit of its production facility to process fresh-cut apple slices in August 2004. Fruit is hand cut in a central sterile room kept a constant 45 degrees Fahrenheit. Personnel can cut 400 to 500 pounds (10 to 12 cases) of fruit per hour. Slices are hand sorted and washed in a vitamin C bath for a 21-day shelf life. Early experimentation found Granny Smith and Empire responded best to the dip; the company is trying other varieties. Slices are dried before packaging.

For its school foodservice contract with the New York State DoD Fresh Program to procure locally grown fresh fruits and vegetables, the company sources New York State apples and packages slices in a variety of different sized bags.

**16. Appeeling Fruit**, is a fresh apple processor located Reading PA. The company has been selling sliced apples to bakeries since 1991. It partnered with Montrose-Hauser in 1998 to test NatureSeal and developed a 2oz. snack package for school Foodservice programs. Today the company markets skin-on Apple Wedges in a 2 ounce snack size in both red (Fuji, Empire, Braeburn, Gala) and green (Granny Smith) and as 20 lb bulk carton. The shelf life is 14 days from processing.

**17. Frosty Fresh/Jard Marketing**, Haverhill, MA is a fresh produce processor. Frosty Fresh is selling sliced apples to retail food chains such as Hannaford, DeMoulas, Shaws and Star Market in clamshells. The company keeps a close eye on product movement. For every multiple outlet client, Jard calls individual stores and places orders within the client’s automated purchase system. Jard calls all accounts every day to see how much they need to order overnight, then processes the order and delivers to the chain’s warehouse.

**18. Del Monte Fresh** operates a fresh cut produce facility in Canton MA. The company is vertically integrated for the procurement of their fruit with the exception of apples. They do not own any orchards. They sell apples slices, mostly in clamshell containers, packaged with a dip.

**19. Missa Bay**, Swedesboro, N.J owned by Ready Pac Produce of Irwindale, CA (Ready Pac is the number one brand of fresh-cut fruit in the USA), is one of several companies that supply sliced apples to McDonalds. The plant processes 50,000 gala apples per day for distribution to McDonald's restaurants up and down the Eastern seaboard. Starting in May 2005 it will supply one-quarter of McDonald's stores with sliced green apples for the chain's new apple walnut salad. (*The New York Times*, February 20, 2005)

(See McDonald's below)

**20. Country Fresh Inc.** of Houston has introduced their brand of sliced apples to retailers (announced in *The Packer* 3-7-05). Red poly bags include Braeburn, Fuji and Gala apples; green bags have Granny Smith. Slices are packed in a 2.8 oz. size for schools, and 8 oz. and 16 ounce for retail. The processing line and was built by FreshExtend Technologies in Vancouver CA a company specializing in fruit and vegetable shelf-life extending products and systems (the company did work on the Mc Donald's Apple Dippers).

## **b. Fast Food Apples**

**1. McDonald's** plans to use 64 million pounds of apples (1.5 million 42 pound cartons, @ 1.5% of the fresh market supply) to make Apple Dippers. A Waldorf type apple walnut salad will add another 40 million lbs. The company began purchasing sliced apples from Peterson Farms, Shelby, Michigan; Fresh Express, Richmond WA and Tree Top (*The Packer* 8/23/2004) and has since added two new processors.

The impact of McDonald's could replicate and exceed its effect on the grape tomato industry that has seen sales increase by 25% since the chain began using the product in its premium salads. McDonald's product entry will serve to speed consumer knowledge, interest and acceptance of sliced apples.

Apple Dippers, a 2.4 oz poly bag of sliced and peeled apples featuring a jogging Ronald Mc Donald were introduced in June 2004 as part of their Balanced Lifestyles program. They are available with Happy Meals and as an a la carte item priced at \$1.00 or \$1.39, depending on the franchise.

Significant R&D and test marketing preceded Apple Dippers. It took four years for the food innovation and development team to get internal approval to move ahead with consumer testing on the Apple Dippers and complete focus group research. The product was tested in Altoona, PA, Columbus, OH and Tulsa, OK in 2003.

Research determined that parents wanted fruit as a healthy choice for their children; apples are kids number one choice for fruit. Slices were determined more acceptable by kids than whole apples. The apple slices are peeled because “peels are like the crust on bread; kids tolerate it, but they don’t really like it.” (*American/Western Fruit Grower* 2/05)

Why package with a dip? McDonald's requires a clear thumbs-up from 70 percent of the people in focus groups to approve any new product and dipless apples didn't make the cut. (New York Times 2/20/05). Caramel dip was selected because “people take their kids to McDonalds for a treat and the caramel is what makes it a treat for them.” (*American/Western Fruit Grower* 2/05)

Varieties for the program were selected for their white flesh color. The roll out began with Gala, Empire, Cameo, and Pink Lady; Crispin and Jonathan have since been added. Fuji was not approved as being too yellow are under review. Gala is the most used variety thanks to its popular flavor, firm juicy character and ease of peeling and slicing. (*American/Western Fruit Grower* 2/05. *The Packer* 8/30/04)

Suitably sized apples range from 88’s to 138’s. Smart Fresh or MCP is recommended to maintain storage quality. (*The Packer* 8/30/04) The company sold more than 35 million pounds of apples in its first year.

Mc Donald’s developed their own anti-browning treatment containing calcium and vitamin C. The product has a 14-day shelf life. Purchases made as part of this study found outdated packages.

**2. Chick-fil-A’s**, an Atlanta-based fast food chain, added a 4 and a 6 ounce cup of diced red and green apples with red grapes, golden pineapple and orange slices to its menus in May 2004. Oxygen and other aging catalysts are removed from the package and nitrogen and carbon dioxide is added to increase shelf life. To assure proper refrigeration at 42 degrees after packaging, the company covers the containers of fruit with cellophane and surrounds the case with ‘thermal blankets’ during transport. The fruit cups are available as a breakfast item and a la carte. ([www.chickfilapressroom.com](http://www.chickfilapressroom.com))

**3. Arby’s**, Ft. Lauderdale, FL, introduced Market Fresh Salads in 2004. The Martha's Vineyard™ Salad has fresh-cut apples, dried cranberries, toasted almonds and diced grilled chicken. ([www.arbys.com](http://www.arbys.com)) Diced apples are sourced from Tree Top (see above).

## 5. Preliminary Financial Assessment

The basic budgets that follow are based on apple yields and plant and manufacturing costs provided by processors. **Basic Budget estimates are the starting place for developing a business plan that would detail sales, income and expenses on a monthly basis.**

### 1. Apple Yield Assessment

Yield 1 is:	65%		
Yield 2 is:	75%		
Apple diameter (inches):	2.75		
oz/apple	5		
oz/yield 1	3.25		
oz/yield 2	3.75		
# lbs apples/case:	37		
# lbs. slices yield 1	24.05		
# lbs. slices yield 2	27.75		
# oz slices/case:		At \$13/case delivered, slices cost the processor:	
Yield 1	384.80	\$0.03	per oz
Yield 2	444.00	\$0.029	per oz

### 2. Typical processing costs to produce one ounce of sliced apples from a yield 1 (65%) apple:

Item:	Cost per ounce:
Apples*	\$0.0321
Packaging	\$0.0107
Labor**	\$0.0107
Coating	\$0.0107
Carton	\$0.0045
Sanitizing materials	\$0.0036
Overhead***	\$0.0286
Support****	\$0.0036
Delivery	\$0.0071
Marketing	\$0.0045
Management	\$0.0071
Profit	\$0.0098
Delivered price per ounce of slices	\$0.1330

#### NOTES:

\* Apples: includes delivery to processor

\*\* Labor: processing, shipping and sanitation

\*\*\* Overhead: facility and equipment loans, depreciation, insurance, utilities, taxes, bad debt

\*\*\*\* Support: secretarial and bookkeeping services, office

### 3. What is the added value from processing?

If a case of whole apples is valued at:	\$ 13.00	
And a 1 oz slice is:	0.13	The added value is:
Then the same case valued as yield 1 slices is worth:	\$ 51.19	\$ 38.19
The same case valued as yield 2 slices is worth:	59.07	46.07

## 6. Basic Budgets

1. **Basic Budget Estimate** for building and operating a proposed 7,500 sq. ft. Apple Slicing Facility

	Year 1	Year 2
<b>Income</b>		
Apple slice sales	<b>\$1,532,571</b>	<b>\$2,043,429</b>
<b>Expense</b>		
<b>1. Personnel</b>	<b>\$315,429</b>	<b>\$342,857</b>
Management: Admin/finance	\$109,714	\$109,714
Marketing: sales	\$68,571	\$68,571
Labor: process/ship/clean	\$137,143	\$164,571
<b>2. Overhead</b>	<b>\$438,857</b>	<b>\$438,857</b>
Bldg, land, site, design, equip (loan payments)	\$153,263	\$153,263
Taxes, leases, etc.	\$70,000	\$75,000
Utilities/water/waste	\$120,594	\$132,653
Maintenance/equip contracts	\$20,000	\$25,000
Start-up materials	\$50,000	
Contingency/bad debt	\$25,000	\$52,940
<b>3. Operations</b>	<b>\$934,857</b>	<b>\$1,110,857</b>
Apples	\$411,429	\$493,714
Packaging	\$137,143	\$164,571
Cartons	\$57,143	\$68,571
Coating	\$137,143	\$164,571
Sanitizers	\$45,714	\$54,857
Delivery	\$91,429	\$109,714
Support (sales, office)	\$54,857	\$54,857
<b>Total Expenses</b>	<b>\$1,689,143</b>	<b>\$1,892,571</b>
<b>Net Income/Loss</b>	<b>\$(156,571)</b>	<b>\$150,857</b>



## Assumptions

Plant output is 500 lbs. of slices per hour.

Apples are purchased for delivered price of \$13/case.

Apple yield is 65% percent.

Slices are sold in 2 oz packs for a delivered price of \$ .27/pack, \$27/ case.

Income based on 9 months of sales.

Personnel and overhead costs based on studies and processor interviews.

Mgt/Marketing personnel included for 12 months; labor for 10 months.

Operations costs based on the experience of one apple slice processor.

Operations costs based on 10 months (5 days, 8hrs. /day); support at 12 months.

Bldg, land, equip etc. cost based on 12 monthly payments on \$1,100,000 loan,

10 years @ 7%; \$300,000 in grants.

Facility is up and running in 2 months.

Year 2 assumes 12 months of operations and sales.

## Proposed Sources and Uses of Start-up funds for an apple slice facility

### Sources

Investor loans	\$600,000	12 investors @ \$ 50,000
Other loans	\$500,000	USDA, Farm Credit
Grants	\$300,000	USDA Value-added Grant

**Total      \$1,400,000**

### Uses

Facility	\$637,500	\$ 85 sq. ft. industry estimate
Land/improvements	\$135,000	Estimate
Engineering/architect	\$63,750	10% of facility cost
Equipment	\$430,000	Industry estimate
Working capital	\$133,750	Start-up mgt/marketing 2 months, Operations 2 weeks, materials, Contingency

**Total      \$1,400,000**

## 2. Basic Budget Estimate for a co-processing business

	Year 1	Year 2
<b>Income</b>		
Apple slice sales	\$408,686	\$817,371
<b>Total income</b>	<b>\$408,686</b>	<b>\$817,371</b>
<b>Expenses</b>		
<b>1. Personnel</b>		
Management/marketing/sales	\$17,829	\$35,657
Travel	\$5,000	\$10,000
<b>2. Overhead</b>		
Bookkeeping/office	\$3,429	\$6,857
<b>3. Operations</b>		
Apples	\$98,743	\$197,486
Co-processing/pack/delivery	\$276,480	\$552,960
Marketing (samples, materials)	\$2,500	\$5,000
Returns/bad debt	\$4,087	\$8,174
<b>Total Expenses</b>	<b>\$408,067</b>	<b>\$816,134</b>
<b>Net Income/Loss</b>	<b>\$619</b>	<b>\$1,238</b>

### Assumptions: Year 1

Contract for 1 day a week for 48 weeks

Income assumes 48 weeks of production, \$27/case of 100 2 oz. packs delivered.

Number of cases sold per week 320

Number cases sold per month 1280

Personnel assumes one staff person for 2 days per month for 12 months

Overhead assumes contracted bookkeeping and office support, 1 day/mo/12 mo.

Operations assumes 48 weeks of production.

Apples at \$13/case delivered to processor. Processing at 9¢ per oz.

Returns/bad debt at 1% of sales.

### Assumptions: Year 2

Contract for 2 days a week for 48 weeks.

Income and expenses double.

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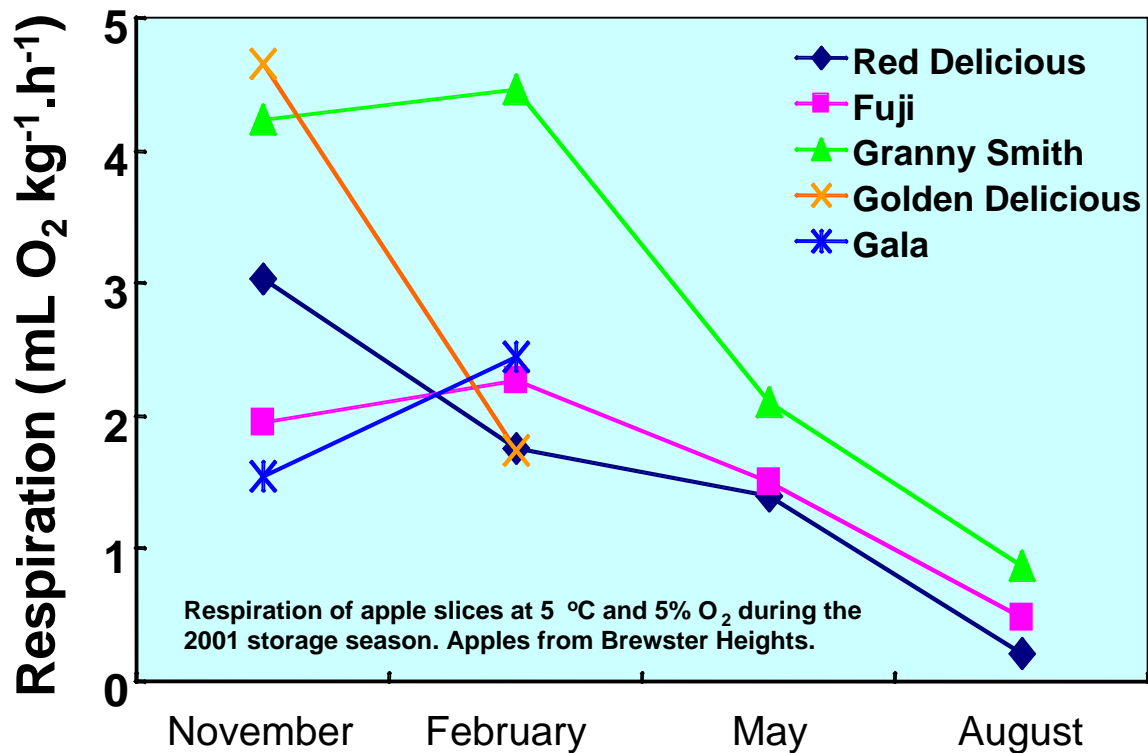
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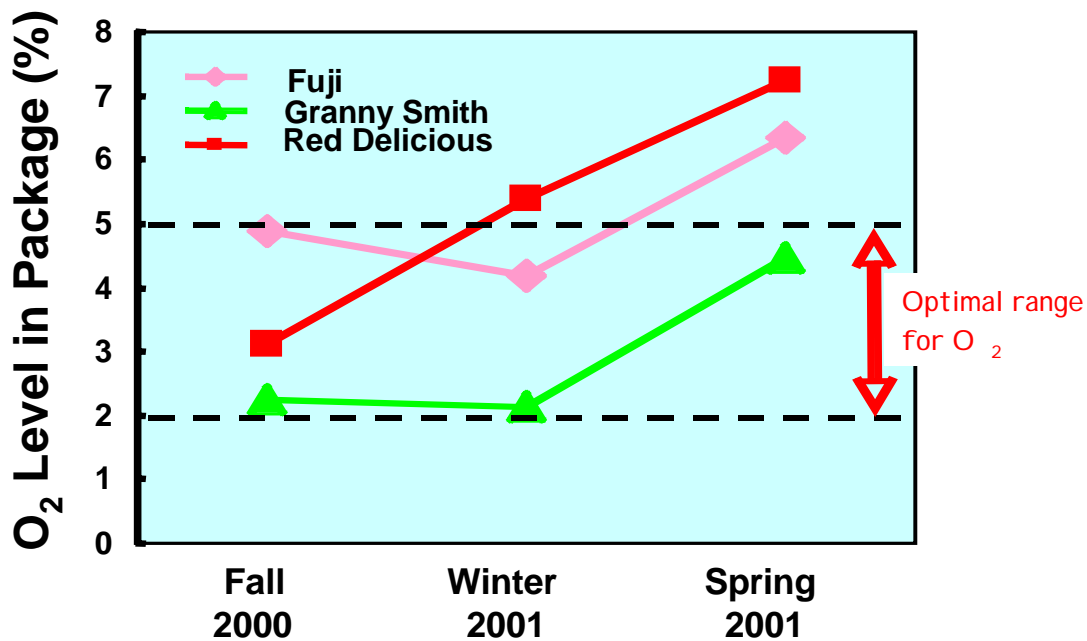
## 8. Appendix

### Exhibit 1. Reichel Apple Products

Product	Case Pack	Case Gross Wgt.	Case Net Wgt.	Dimension	Tie. tier	Case Cube	Shelf Life	Cases Pallet
Apples n' Caramel	12/4.2 oz.	4.2 lbs.	3.2 lbs.	12.0625 x 7.5 x 6.0	20 x 12	0.31	27 Days (at delivery)	240
Apples n' Caramel w/ Nuts	12/4.0 oz.	4.0 lbs.	3.0 lbs.	12.0625 x 7.5 x 6.0	20 x 12	0.31	27 Days (at delivery)	240
Apples n' Fruit Dip	12/4.1 oz.	4.0 lbs.	3.1 lbs.	12.0625 x 7.5 x 6.0	20 x 12	0.31	27 Days (at delivery)	240
Apples n' Peanut Butter	12/4.1 oz.	4.0 lbs.	3.1 lbs.	12.0625 x 7.5 x 6.0	20 x 12	0.31	27 Days (at delivery)	240
Apples and Caramel w/ Ham, Cheese and Crackers	12/7.4 oz.	7.1 lbs.	5.6 lbs.	17.44 x 7.7 x 8.25	14 x 7	0.64	27 Days (at delivery)	98
Apples and Caramel w/ Turkey, Cheese and Crackers	12/7.4 oz.	7.1 lbs.	5.6 lbs.	17.44 x 7.7 x 8.25	14 x 7	0.64	27 Days (at delivery)	98
Apples n' Caramel Dip Party Tray	6/26 oz.	11 lbs.	9.75 lbs.	20.875 x x10.4 x x5.563	6 x 10	0.7	17 Days (at delivery)	60
Apples n' Fruit Dip Party Tray	6/26 oz.	11 lbs.	9.75 lbs.	20.875 x x10.4 x x5.563	6 x 10	0.7	17 Days (at delivery)	60
Sliced Bulk Apples - Tart	4/4.0 lbs.	18.0 lbs.	16.0 lbs.	20.9375 x 12.8 x 7.25	6 x 7	1.125	27 Days (at delivery)	42
Sliced Bulk Apples - Sweet	4/4.0 lbs.	18.0 lbs.	16.0 lbs.	20.9375 x 12.8 x 7.25	6 x 7	1.125	27 Days (at delivery)	42



Thus packaging atmospheres change, meaning you cannot have an optimal atmosphere and therefore must make film compromises.





### **Exhibit 3. Consumer responses to packaged fresh sliced apples**

The following section is an excerpt from *Thinking Afresh About Processing: An Exploration of New Market Opportunities for Apple Products*. Kristen L. Rowles, Brian M. Henehan, Gerald B. White, Department of Applied Economics and Management, College of Agriculture and Life Sciences, Cornell University, Ithaca, NY, Staff paper 2001-3, June 2001. Pages 85 to 91.

#### *Fresh Apple Slices*

...Few consumers have had experience with the product, as noted in the focus group discussions. Only one participant had heard of or seen the product before attending the focus group. Also, although the product exists in the market, numerous product designs are possible, including variations on packaging, size of pack, non-browning treatment, combinations with sauces and other foods, flavors, and apple varieties. There is a diversity of potential opportunities for the development of new fresh apple slice products, as well as new distribution and marketing strategies for these products.

We presented participants with fresh slices of the variety NY 674, a new, unnamed variety developed at the New York State Agricultural 86 Experiment Station. This variety was chosen for the prototype samples by the food scientists due to its availability through this project, and also because they were engaged in assessing the variety's non-browning characteristic in this application for their own research under this project. The samples were treated with ascorbic acid to prevent browning, and they had been sealed in plastic packages and stored at 32 degrees (Fahrenheit) for several days. They were delivered on ice in a cooler to the focus group sites. Although this variety has non-browning characteristics, it still required treatment with ascorbic acid for use in this product. Also, a broad range of other apple varieties that do not have the non-browning feature can still be used in this type of product with the application of ascorbic acid based dip.

The samples were presented to participants on a plate. They were told that the slices had been prepared several days prior. If they asked, they were told that the slices had been treated with a "natural" coating. Later in the discussion, they were given more information on the formulation of the treatment. They were not told which apple variety was used to make the samples.

First, before tasting the product, the participants were asked to evaluate the appearance of the product. Their responses appeared to indicate a genuine interest in the product based on its appearance. They found the appearance very clean and fresh looking. Comments included:

- .. "Very fresh looking"
- .. "Like they were just peeled"
- .. "White, unbruised"
- .. "They look better than if I cut up a pile of apples, because they'd already be brown."

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- .. “They look perfect.”
- .. “They look clean. They look bright red.”

While they responded positively to the appearance, they also expressed some skepticism and mistrust about non-browning of the slices. Comments included:

- .. “These are real apples? I’m amazed. Because the discoloration of an apple is a big turn-off to me.”
- .. “It wouldn’t stay that way. It’s got to be some kind of an artificial...chemical.”
- .. “Why didn’t they turn brown? I’d want to know what was on it...”
- .. “They must have put...sulfides or whatever they call them.”

Next, they tasted the samples. Reactions to these samples were mixed. Several praised their texture and juiciness:

- .. “I thought it was crisp and felt cool and refreshing...”
- .. “It was crisp, which is, it was crunchy. It was moist. It was a little tart.”
- .. “It was fresh. It was juicy.”
- .. “It was good and crispy. I can see even the napkin’s [on which it was sitting} moist. It is juicy. As far as a tart apple goes, it was a good apple.”
- .. “It was juicy. It’s on the tart side, but I like tart apples, too. The main thing that it wasn’t a dry apple. I thought it was good.”
- .. “It’s got a nice balance between sour and sweet.”

On the other hand, others found the taste disappointing. Their comments included:

- .. “...it didn’t really have flavor, per se.”
- .. “I didn’t particularly care for the taste or the crunchiness.”
- .. “It didn’t have that real apple taste that I like. Something’s missing.”
- .. “...but I just expected more from it, something else I require.”
- .. “They look great. I thought they would taste the same and I didn’t like them at all.”
- .. “It looks fresh and it smells fresh, but to me, that taste was just not there.”

A few of the women said that the taste improved after some “getting used to.” For example, one of them said, “When I tasted the first slice, I didn’t like it as much as when I tasted the second slice. I got used to the taste more.” However, some felt that the samples taste somewhat counterfeit. For example, one said, “It tasted like it was not real almost. It tasted like it was a...like a synthetic kind of apple.” Another said, “It tastes like there was something else in there.”

Some of the comments were more likely specific to the variety of apple used. Most participants said that they prefer sweet apples, and most perceived these samples to be a tart apple variety. Comments included:

- .. “Too tart. I prefer a sweet apple.”
- .. “A little bit too tart for my perfect apple.”
- .. “To me, it wasn’t sweet enough, but I like very sweet apples. It was a borderline apple.”
- .. “I got a lot of tart and not enough sweet.”

The treatment with ascorbic acid may have increased the sensation of tartness. Formal taste testing would be required to understand reactions to varieties and to separate responses to varieties and responses to non-browning treatments.

A few of the women said that they would like to know what variety of apple was used to make the product. Another noted that she would like to be able to buy packages with several varieties, in order to appeal to a range of tastes in her household. She said:

I would buy it if it was a variety. If there was a variety, kind of like a trail mix, an apple trail mix. Children like varieties and this one is a little sour, this one is a little sweet. I personally would buy a whole bag of just sweet apples, but my daughter, I'm sure she would like the variety of apple slices.

When asked to describe the aroma of the slices, most of the participants said that the aroma was faint, nondescript, or indiscernible. A few thought the aroma was vinegary, and a few thought it was fresh.

The participants identified several benefits of the product. In addition to the lack of browning, they primarily noted the convenience of the product. Comments included:

- .. "You know, giving it to your kids. It's quick, it's easy, it's clean. There is no trash. You take them to the park with you. It would travel."
- .. "They're ready to eat."
- .. "No core to dispose of."
- .. "The convenience."
- .. "There's no pits in them."

They could name several occasions for product use including snacks and lunches, especially for children. Some said that the product would be useful in the preparation of pies, salads, and casseroles, but at least one woman noted that the product would need to be peeled for most cooking and baking applications. One woman commented on the value of this product for children:

I teach little children, and if you would see what they come in with, this would be a welcome addition to a lunch box...because parents just are too lazy to make anything like cut an apple up. I never see an apple cut up, never, ever. Only if they come from a home that's really into this natural stuff. And I've been doing this for a long time.

Another woman suggested a specific Jewish holiday application for this product:

I'm Jewish so we celebrate Rosh Hashanah and sliced apples are a big tradition. You have to have apples and honey. I agonize over that when I slice my apples, if they're going to turn brown before the company gets there. If I can buy apples like that? That would be good. That's a gold mine.

In each group, about half of the participants said that they would buy this product. Several who said that they would buy the product said that they would use it as an ingredient in cooking or baking. While this use may represent an important market, it also may not support a premium price for the product.

When asked about prices, the women said that they would expect to pay anywhere from \$1.19 to \$5.50 for a one pound bag of sliced apples in a re-sealable pouch. This packaging and size of pack had not previously been suggested in the discussion. It was chosen because of the relative ease of participant's to envision the size of a one-pound package. The average price suggested was \$2.57. However, again, these results should not be interpreted as a statistical representation of the target market. Instead, the range of prices provides a basis for further study of price levels for the product. The broad range of prices suggested for this product indicates a need for further study, but it also indicates that perhaps consumers do not have a good sense of what they would expect to pay for this product. This uncertainty might provide an opportunity not available with products for which consumers already have a strong sense of price.

Evaluations of the taste of a product are highly dependent upon the formulation of the samples used. This limitation makes it difficult to extrapolate from these results to project consumer reactions to the product in the market. The results provide detailed information about reactions to a specific variety, but based on these results, this variety may not be the best choice of cultivar for this product. Also, as noted above, the samples may have been perceived to be relatively tart in part because of the ascorbic acid treatment. Taste testing would be needed to evaluate the effects of variety and treatment on consumer reactions.

Taste testing is a research technique commonly used in the middle stages of product development. It is used to assist in developing the formulation for a product. These focus groups were intended as a earlier stage research technique, and therefore, comments about taste and formulation should be interpreted carefully. This study was not designed to assess these factors definitively.

While this study did not identify a specific, preferred product formulation, the results point to several areas of opportunity and questions for further research with this product. First, as described above, formal taste testing would be needed to support the development of product formulations. In these focus groups, it appears that most of the women would prefer a slice that is relatively sweet.

Second, several women felt that the product showed potential for baking and cooking applications. Further research would be needed to evaluate the size of the retail market for this product as an ingredient. With general consumer trends moving away from traditional baking and cooking and toward easily assembled meals, the market for a product oriented toward baking or cooking might be limited. On the other hand, perhaps opportunities exist for products, including apple slices, which provide consumers with an easy to prepare meal or dessert. For example, a fresh apple cobbler kit that could be prepared quickly might appeal to consumers as a product that is both convenient and nostalgic.

Third, among the best scoring products in the consumer survey discussed in Section III were snack packs, which combined fresh apple slices with crackers and cheese, caramel dip, or peanut butter. These products offer convenience value and support parents in providing their children with something healthy. This application of fresh slices warrants further research and

development.

Fourth, participants raised one unique opportunity for occasion marketing: Rosh Hashanah. This opportunity might be used to build product interest. Occasion oriented packages could include servings of honey.

Fifth, concern over the treatment of the slices may present a marketing challenge for this product. Consumers expect apples to brown, and when this product did not brown, it raised questions in the minds of the focus group participants. Most of them were reassured when we later discussed the formulation of the treatment. Some even felt that ascorbic acid treatment might be promoted as a benefit because it is a source of vitamin C. However, their initial reactions are important....food safety is an important consumer concern. Comments in the focus groups indicated that concerns about undesirable ingredients could be significant. Marketers of this product should address these concerns.

Finally, overall, consumer reactions in the focus groups were generally positive to the concept of this product. Earlier discussions in the focus group sessions indicated the potential for this product to exploit a market opportunity by overcoming consumer dislikes about apples. A product that adds value with convenience in this way may not appeal to the broad market, but the data in this report point toward potential opportunities in particular market segments. In the focus groups, consumers generally liked the product concept, praised the product appearance, and could suggest use occasions for the product. Several concerns were also identified. However, with further study, this product appears to show promise....